Electrical World

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Commissions in the Constitution

BEFORE the New York State Constitutional Convention, now in session, are several bills providing that memberships on the Public Service Commissions be made constitutional offices; that is to say, that they be freed of their present unfortunate subservience to acts of the Legislature. The bills, which have been referred to the public utilities committee of the convention, differ in detail but are agreed as to principle. Even if the commissions are brought within the protection of the constitution, failure to act on the important details may make a vital difference in the result. To make the commissioners constitutional officials will remove them one degree from the political interference that is inescapable when the Legislature follows its whims with the body that it can undo. To give the commissions complete power in rate-making and to deprive the Legislature of all authority in this respect will remove them farther from the irritation of uninformed legislative action. Some state executives, notably Governor Hughes, have protected commissions by vetoing rate-making bills passed by the Legislature. If commissioners are worthy of office, independence of the Legislature is as desirable as independence of every other interest, and provision for it is a clear public duty of the constitutional convention.

Merger of Electrical Properties

IN approving the proposed merger of five hydroelectric properties in Idaho the Public Utilities Commission shows thorough understanding of the settled economic principles involved. The substitution of one organization for five, the interconnection of all distributing systems, the displacement of small generating plants by the large plant operating at less cost, are factors of such strength and demonstrable influence in service and rates that state commissions generally favor such movements. In the Idaho case the importance of the changes is accentuated by the fact that the companies entering the combination had engaged in rate wars that had sapped their resources and credit and correspondingly crippled their ability to provide the best service. The arrangement assures the same monopoly in a territory of wide extent that has been proved to be economically wise in individual communities. Monopoly of electric utility service in a city leads logically to monopoly of service in extensive areas comprising groups of communities where conditions of generation, transmission and the market for energy lend themselves to this highly economical type of development. Idaho furnishes the latest illustration of this character of upbuilding, but many others exist, some of the most conspicuous being in Illinois. The commission's conclusion that because the statute gives adequate power to regulate service and rates no danger to the public is to be apprehended from such monopoly records another authority in support of the inevitable and wholesome tendency of the industry's progress.

"Electric Light"

AS a designation of central-station activity the phrase "electric light" in titles of companies and associations has become a misnomer. It had its place when the sale of energy for lighting represented practically all of the commercial service rendered. With the subsequent broadening of the industry many of the later companies adopted titles more in keeping with the larger trend of their operations. The most common term incorporated in titles to express the more important direction of the business is "power." The public interprets this word as intended, whereas a more accurate technical designation might not be comprehended. Unfortunately, the Bureau of the Census report does not state the proportion of revenue obtained from the use of energy for different commercial purposes. It classifies together "commercial light, power and heat," from which 73.2 per cent of the total income of central electric stations was received in 1912. The experience of separate companies, however, is a general indication of the large amount of energy sold for motor-service as compared with the small amount used for lighting. The sentiment attached to the early title and its adaptation, "illuminating," will help to guard them against destruction by a modern idea based on the wonderful scope of the service now furnished.

High-Voltage Transmission in Japan

WE conclude this week an account of one of the world's notable transmission plants, erected for the supply of energy to Tokio, Japan. The working pressure is the highest outside the United States, 115,000 volts, and the transmission distance from Lake Inawashiro, the source of energy, to Tokio, 145 miles, causes the line to be one of the longest outside this country. Aside from these features, the plant is out of the ordinary in that the apparatus came from makers in various countries, and part of it had to be so designed that it could be transported over the Japanese Imperial Railroad, which is of narrow gage. A masonry dam thrown across the Nippashi River, the outlet of Lake Inawashiro, which serves as a storage reservoir,

gives a working head of 350 ft. Generally speaking, such a head lies in the debatable ground between impulse wheels and turbines, but in this instance the extent of the utilization, which called for a total of some 60,000 hp, made it desirable to use large units, and for these the turbine was considered the more desirable. An interesting feature of the high-voltage system resides in the use of condenser-type terminals for the roof bushings and the provision of static shields to check coronal discharge. The station is protected by electrolytic lightning arresters placed out of doors for the 115,000-volt lines and indoors for the 6600-volt feeders. The whole switching system is arranged for remote control with a single desk control board in the switch gallery overlooking the generator room. The transmission system consists of a line of double-circuit steel towers with a circuit carried on each side. The line to Tokio is divided into four sections by three outdoors sectionalizing stations. Each of these is provided with equipment for tying together or cross-connecting any two lines. The standard towers are 72 ft. high, set about 550 ft. apart, although for river crossings special towers are provided. One of these crossings, over 1500 ft. in length, required 220-ft. towers, between which are strung conductors of ⅝-in. stranded steel. This fine plant, we are glad to say, is of American design, and most of the electrical equipment was manufactured in this country. The rest of it is of English make, while the turbines were obtained from Germany. The installation represents an admirable example of thorough construction quite worthy to stand well up in the list of the world's important transmission plants.

Flux Distribution Over Armature Surfaces

The distribution of magnetic flux over the surface of an alternator armature at no load is a necessary predetermination for the wave-shape of no-load-generated voltage. Every designer of alternators who wishes a machine to generate a sinusoidal emf must first know the distribution of flux density over the surface of the armature, in order to arrive at the wave of total emf generated in the armature coils. There are various ways in which designers arrive at an estimate of the flux distribution over the armature. Some are experimental, others purely empirical, and others again are based upon experience with similar designs in the past. In this issue Prof. Alfred Still contributes an article on the subject which is well worthy of consideration. In the first place, it is based on sound permeance theory, and in the second place it is worked out in the metric system, so that it is easily understood. Excellent constructive work in the machine shop can be and is done, as we all know, in the absurd existing English units of measure; but scientific work cannot properly be carried out in such barbarous units, and engineering publications employing English units exclusively condemn themselves automatically to the inferior grades of world recognition and world advancement.

Two graphical methods are presented in the article for finding the wave-form of armature-surface flux density and the total air-gap permeance. The first method follows closely that suggested by Lehmann but which takes a relatively large amount of time to complete. The second is a new approximation to the same result by an abbreviated graphical process. In each case the reluctance of the armature teeth is left out of consideration, but the tooth-reluctance correction is a separate step of further approximation and can be dealt with by known methods. In the case of alternators the tooth-reluctance correction is not hard to apply.

The method described applies essentially to the no-load condition of the armature. An additional correction, which is sometimes very considerable, has to be applied for the effect of armature-coil mmfs at rated load and at various power-factors. However, this, too, is a separate step and can be dealt with by known methods. The method, as described, is based essentially on two-dimensional analysis. It is capable, however, of being modified in detail, as a further refinement, to take into effect the corrections for three-dimensional analysis.

The Unit of Candle-Power in White Light

In the alleged happy long-ago of artificial illumination, when open gas jets and tallow candles had it all their own way, the photometer man was not troubled seriously by color differences between the illuminants he compared. Nowadays, however, the conditions in practical photometry are very different, and every year makes the color differences more salient and inevitable. Like taxes, they admit of no honest escape. Heterochrome photometry has come with every indication of a rooted determination to stay.

There is very little hope of securing a reliable photometric balance in the ordinary photometer between two strong lights of widely different color—say, a vivid blue and a vivid red respectively. Different observers differ remarkably in their estimates of photometric comparison in such cases. There are, however, two known methods of attacking the problem. One is to use the flicker photometer, and the other is to use the ordinary photometer by cascade method, with a number of intermediate steps, each of so small a color difference that observers can agree in their comparisons. Both methods have their advocates. There is a large literature on the subject of the choice. Preference hitherto has favored the cascade method. Some day it may turn.

An interesting paper on the cascade method as used in the National Physical Laboratory of Great Britain has recently been read before the British Physical Society by Messrs. C. C. Paterson and B. P. Dudding. The authors show that in order to arrive at reliable values for the candle-powers of high-efficiency tungsten-filament incandescent lamps in terms of carbon-filament standards, it was considered desirable to calibrate five intermediate sets of auxiliary standards, of corresponding intermediate color tone. Moreover, since each aux-

iliary standard was photometered with the aid of an intermediate working standard, by the substitution method, the total color difference between the initial carbon and final tungsten standard was virtually divided into ten photometric steps, none of which was great enough to embarrass the six different observers engaged in the work.

It is interesting to observe that the British photometrists still seem to adhere to a specified flame as their fundamental standard. That is, if we understand the paper correctly, they regard the British pentane lamp as their fountain-head of candle-power and calibrate their working-standard incandescent lamps therefrom. For international purposes this procedure is satisfactory to photometrists all over the world, so long as the group of international incandescent standards are found to be at par, as they are so far indicated to be. In this country we have no fundamental flame standards, and we stand by the groups of internationally exchanged incandescent lamps, which, it is generally believed, are capable of maintaining the international candle more faithfully than any flame.

Load-Factor of the Rand System

Probably considerable research would be required to determine which of the existing great electrical energy supply networks throughout the world must be called the greatest. However, there seems to be little doubt that the network for the supply of energy to the mines on the South African Rand is altogether the largest devoted essentially to motor service. To a certain extent the load on every network is a mixed one. The Rand system differs from all others in that by far the largest part of the energy generated is devoted to motor service in the mines for one purpose or another, the energy thus supplied reaching nearly 2,000,000 kw-hr. per day. This service gives to the system unique characteristics in the way of uniformity of load. The work consists largely in driving air compressors, hoists, stamps and the like, all operated on about the same time schedule and many of them operated for very long hours with double shifts.

Of the total energy generated, 98 per cent is used in the mining industries, so that the general industrial service and wholesale supply to a few municipalities is trivial as compared with the motor load. There are sixty-five consumers in the mining industry, and the character of the load on each of these is essentially similar, there being just enough diversity between one and another to smooth out the load curve to some extent. In this service the peak occurs at midday with a second maximum in the late forenoon. The minima fall at about 6 a. m. and 6 p. m., but even at these times the load remains equal to two-thirds of the peak. The result of this situation is that with the enormous yearly output the load is still singularly steady, the average load-factor on a weekday being fully 80 per cent for the Rand system with a maximum output of from 90,000 kw to 100,000 kw. It is this feature of the loading which produces almost ideal conditions for generation of energy in the several plants.

Not even our largest central stations engaged in the wholesale supply of energy for railway purposes come anywhere near to the Rand plants in the matter of load-factor. For example, Chicago is well known to represent probably the most advanced central-station practice in the world and the most far-sighted management with respect to the furnishing of energy in blocks. Its network has spread over a great territory, much attention has been paid to the diversity-factors and consummate skill has been displayed in operating the system, yet figures taken from a recent paper show that the Chicago load-factor is barely over two-thirds that of the Rand system. While in Chicago 90 per cent of the peak rating is used for something over 100 hours per year, the Rand service runs to the same proportion of its peak for about 1000 hours per year. If the Rand system could take on a considerable amount of traction and lighting, which for it would be off-the-peak load, these extraordinary conditions of service would become still more remarkable. Herein lies one of the possibilities of startling developments in electrical energy supply. Given a widely ramifying network, it is possible so to obtain diversified service as to gain for the system a degree of uniformity of load hitherto unapproached. To reach this end there must be added, in the case of systems doing a large lighting and traction business, such industries as will bring a distinctively day load. The Rand mines start with this, and for their purposes of raising the load-factor need lighting and railway work, of which the peaks occur during the morning and evening.

Few central stations can command great mining industries for customers, and industrial loads in general overlap on the lighting and traction peaks. Some of the electrochemical industries offer an opportunity for filling up the gap, and these should be assiduously cultivated. If, however, the industrial miscellaneous day load can be obtained on a scale large enough, the lighting and traction load will not raise the peak enough seriously to damage the load-factor. The conditions on the Rand are unique in that the mine load comes on quickly not far from 8 o'clock in the morning and drops as quickly about 4 o'clock in the afternoon, thus avoiding completely the ordinary lighting peak. In a large measure what has been done on the Rand can be repeated in any great industrial region developed from the standpoint of motor load. And when load-factors reach the Chicago figure the running conditions of the central station become so good that it is economically possible to take on service of a character which could hardly be reached under ordinary generating conditions. Huge output does not necessarily itself involve great economies in the production cost of electrical energy, but when this output is in the same time reduced to approximate uniformity hour by hour and day by day, very great gains are possible. The Rand certainly furnishes an example of load-factor and load-curve worthy of emulation even in the face of enormous difficulties.

LETTERS TO THE EDITOR

Initial Current Rush of Tungsten-Lamp Loads

To the Editor of the ELECTRICAL WORLD:

SIR:—In the letter by Mr. D. C. Black on page 1285 of the May 22 issue of the ELECTRICAL WORLD, regarding the initial rush of current in tungsten lamps, mention is made of "transformers," which introduces an interesting phenomenon that may explain the difference between Mr. Black's experience and that of others, who have employed direct current rather than alternating current.

As the writer understands the operation mentioned by Mr. Black, the primary terminals of a transformer (whose secondary is connected with a load of tungsten lamps) are disconnected from one alternating-current circuit and connected with another.

The magnetism in the iron core of a transformer in normal operation changes direction twice during each cycle of alternating current, and the counter-electromotive force, producing the choking effect that prevents a large current, is constantly in the proper direction relative to the applied pressure. As is known, the ohmic resistance of the windings of a transformer is low, so that the application of a unidirectional pressure having the same numerical values in volts as an alternating pressure will produce relatively a much larger current.

When the terminals of a transformer are disconnected from an alternating-current supply, the magnetism of the core of the transformer may be zero or it may have some numerical value in either one direction or the other, depending at what point of time relative to a single cycle of current the circuit is broken—a matter of chance.

If the magnetism of the core of a transformer were zero, then there could be no counter-electromotive force, no choking effect, and hence a very large resulting current with an alternating applied pressure.

If the magnetism of the core of a transformer should be in a given direction and the suddenly applied alternating pressure should be applied at an instant causing a current tending to magnetize the core momentarily in the same direction, the resulting current would be greater than if the magnetism of the core were zero. The connecting of the terminals of a transformer to alternating-current mains at the proper instant to have all the conditions act together for a maximum rush of current is therefore a matter of chance.

The relations of applied pressure, magnetism, counter-electromotive force and resulting current mentioned are true whether a load of tungsten lamps is or is not connected with a transformer.

In experimenting with small transformers of from 300 watts to 500 watts, having exciting currents of not over 0.2 amp, the writer has observed initial rush currents up to 15 amp, both with and without connected loads. This phenomenon makes it advisable to provide all ammeters with short-circuiting switches when employed for testing transformers.

In transferring a transformer from one circuit to another it is advisable to connect a choke coil in series with the transformer before connecting it with a circuit. After the line connections have been made the choke coil may be short-circuited.

While a given transformer (with no lamps connected) when being connected with an alternating-current supply might cause the blowing of the main fuses, it might be found after it is properly in circuit that applying a sudden load of tungsten lamps to the same transformer will not cause the same size of fuses to blow. In performing such an experiment from twenty to thirty trials should be made, because the element of "chance" is present.

Hanover, N. H. F. E. AUSTIN.

Uniform Electric Rates Based on Costs

To the Editor of the ELECTRICAL WORLD:

SIR:—Although practically every court and every commission from Massachusetts to California has given decisions, not only against uniform electric rates obtained by dividing the kilowatt-hours into the total costs, but also against rates obtained by dividing kilowatts of demand or number of customers into any portion of the costs, yet the idea continues to crop up.

The possibility of doing business on the basis of uniform rates would solve, or rather enable one to neglect, certain serious problems, and this is undoubtedly the reason why the idea of uniform rates is so often advanced.

While uniform rates under the same conditions—that is, when the service is supplied under the *same* circumstances—are almost a foundation of our law, yet to make uniform rates for classes or customers, even when the circumstances are *not* the same, always results in such high rates and limited business that not only business men, customers as well as corporations, but also the courts and commissions rule against them whenever an attempt is made to put them into practice—excepting, of course, those cases where the natural rates as determined by supply and demand happen to be the same.

The idea of uniform electric rates based on costs is so beautiful in its simplicity that it is very alluring. Its danger and difficulties appear only when it is put into practice, and as a result there are many people who, as it were, proclaim the principle but go no further; and it is almost as difficult to disprove their claim as it is to prove to the dreamer that he cannot square the circle or invent a perpetual-motion machine.

A paper presented at the recent mayors' convention in Philadelphia on the subject contained some interesting questions and answers, as follows:

Question 1. What difference, if any, should there be in the rates charged for residence use and in the rates charged for business purposes?

Answer. None.

Question 2. What difference, if any, should be made between users of electricity for power and users of electricity for lighting, assuming that these uses are at the same periods?

Answer. None.

Question 3. What difference, if any, should be made in rates between users of electricity for a short period per day and those for a long period per day?

Answer. Maximum justifiable difference is, in my opinion, limited to one-half the total annual charge for interest, taxes and amortization divided by the kilowatt-hours supplied during a five-hundred-hour peak load period (four hours a day for 125 days). This differential in an assumed case amounts to 2½ cents per kw-hr. between a twenty-four-hour user off the peak and a one-hour user on the peak.

Question 4. What is a uniform rate, assuming that by uniform rate is meant one in which the return from each classification of consumers will contribute, in addition to cost of serving it, the same proportion to profit,

fixed and overhead expenses as every other classification?

Answer. A compound rate made up of (a) peak-load demand charge, (b) consumption charge, peak load being based on unbiased determination of actual demand made by each classification of consumers on the station during peak-load period.

For all usual classifications—such as residence, commercial, light and power—a flat rate to all except long-hour off-peak users would be substantially fair, as the differences in cost of supply would not be sufficient to amount to inequitable treatment.

Question 5. What difference, if any, should be made in rates because of quantity used?

Answer. None.

The above answers have been based on the division of the costs into various items, as production, transmission, electric storage expense, etc.

Now, the assignment of the actual expenses, such as the cost of coal, to any one of these items is purely arbitrary. For instance, coal is put down as a production expense, but when it is remembered that there is a waste or loss of electricity in transmission, in storage and in distribution, and that coal is required to produce the electricity thus lost, it becomes obvious that the amount of transmission expense depends on whether some of the coal is charged to that account or whether all coal is charged to production.

Hence, if the rates are computed from these divisions of costs, they will depend on how much is charged to each account, which will depend on the discretion of the bookkeeper or of the accountant who decided what proportion of each bill or payment should be charged to each account.

The next fallacy, or rather opportunity for a fallacy, is the idea that the so-called production expenses, such as the labor, fuel, etc., are not affected materially by the character or the period of use by the consumer. This implies that only the costs per kilowatt-hour are being considered. The actual coal cost in dollars and cents does, of course, vary with the consumer's use, but the cost per kilowatt-hour varies very little.

It is also stated that the transmission expenses, storage-battery expenses, etc., apply to all consumers alike. Now, this is true only when considering the actual costs in dollars and cents, and *not* the cost per kilowatt-hour. Consider first a customer who uses 100 kw-hr., and see what happens if he uses 200 kw-hr. It may be true that the expenses for the coal are the same per kilowatt-hour, because the added kilowatt-hours involve a proportionate increase in coal costs. It may also be true that the expenses for transmission, storage, etc., are the same in dollars and cents, because the added kilowatt-hours do not involve a proportionate increase in costs of transmission. But both statements are not true in the same sense.

The point is that the "cost" or "expense" is used at one time as the cost per kilowatt-hour and at other times as the actual cost, and this, of course, results in errors. This fact is brought out again by another computation, in which it is shown that the meter expense for a certain class of customers is in the neighborhood of $6 per meter, or 0.43 cent per kw-hr. Consider the case of a customer who uses only 10 kw-hr. a year, as sometimes happens. The meter cost is 60 cents per kw-hr. for that customer. If it is proper to divide a certain kind of expense (such as the meter expense) by the kilowatt-hours used by a class of customers (such as residence customers) to determine the cost per kilowatt-hour to be used in rate-making, then it is proper to select the class of small customers instead of the residence customers, and as this would give an entirely different rate, it becomes clear that when rates are computed from costs the actual rates depend on the method of selecting the classes, which in turn depends on the discretion of the rate maker. Since rates will also vary with the discretion of the accountant in making up classes of expenses, it becomes apparent that rates computed from costs depend more on discretion of accountant and classifier than they do on the costs.

Continuing with the method of computing rates from the costs, it is to be noted that certain costs are called demand costs and charged up against the peak load. However, not all but only one-half the demand costs are charged against the peak. Of course "half-and-half" or "fifty-fifty" is nearly as beautiful an idea as "uniform rates." If five customers use energy during the peak and only three off the peak, why should exactly half of the demand expense be divided among the five? Moreover, in computing the peak charge, it is assumed that the peak lasts 500 hours! Why not one hour, or ten hours, or one hundred hours? If a peak of one hundred hours had been chosen instead of five hundred, the actual rates would be very different, and if peaks of one hour were used, still more different.

Again, it is clear that if uniform electric rates are based on costs, the actual rates will depend on the discretion of the computer fully as much as on the costs.

Finally, let us take a case fairly well known, namely the New York Edison Company and Third Avenue Railroad Company. I do not use actual figures because I do not know them.

The railroad company was producing energy for, say, 1 cent per kw-hr., all charges included. The New York Edison Company was producing energy for, say, 1.1 cents at its station, all charges included, and at an average cost of say 5 cents delivered, all charges included.

The New York Edison Company then buys or rents the Third Avenue generating station, assumes all charges and expenses, but makes no connection to its own plants. Obviously, it can sell energy to the Third Avenue company at 1 cent, though it makes no profit. Then it makes a physical connection and rearranges the load so that its actual expense becomes less. It can then afford to reduce its prices to all its customers, including the railroad company.

In the meantime, however, the uniform electric rate maker comes along and finds that the average cost of energy to the New York Edison Company, based on all its expenses and charges divided by the kilowatt-hours supplied to all customers, including the railroad, is, say, 3 cents. Does it, therefore, follow that the rate to the railroad company should be raised to 3 cents? If it does, the Third Avenue Railroad Company will quickly build a new station of its own and cease to buy energy from the New York Edison Company.

The article on uniform electric rates on which this letter is based contains some other discrepancies, but the above shows how the calculations necessary to compute rates from costs depend even more on the personal discretion of the rate maker than do the ordinary rates approved by commissions and courts, and it should also be clear how very dangerous to the public would be such cost computation unless excellent discretion were used in making up the classes.

It should also be noted that the objections to basing rates on cost apply solely to the question of relative rates to different classes. There is no dispute that the total of all the charges to all the customers should be equal to, and no more than, the total of all expenses, including fair fixed charges, etc.

The total of the rates depends on the costs, but the relative bills or charges to classes of customers cannot be uniform and cannot be computed from the accountant's cost.

Lynn, Mass. WILLIAM ADAMS.

Hearing on Renewable-Fuse Matter

Notice of a public hearing at the Bureau of Standards, Washington, D. C., July 8, on a joint appeal of the Underwriters' Laboratories, Chicago, and the Economy Fuse & Manufacturing Company, Chicago, has been issued to manufacturers of cartridge fuses and to electrical inspection departments of municipalities and underwriters' associations by Dr. E. B. Rosa, acting director of the Bureau of Standards. Following is the question for a decision on which the joint appeal has been made to the bureau:

"Has it been shown that the use of the fuses manufactured by the Economy Fuse & Manufacturing Company results in no greater fire or accident hazard than the use of other cartridge inclosed fuses at present listed as standard by the Underwriters' Laboratories?"

The evidence on which the decision will be rendered, Dr. Rosa announces, is to include that which is presented by the Underwriters' Laboratories, by the Economy Fuse & Manufacturing Company, by other manufacturers of cartridge-inclosed fuses, and by state, city or insurance inspectors, all such evidence being subject to investigation or check by the Bureau of Standards as it may see fit.

The public hearing at the bureau will begin at 10 a. m. July 8. Written statements will be received by the bureau on or before that date, in lieu of personal attendance at the hearing. Written arguments in rebuttal of statements made at the hearing may be filed with the bureau within fifteen days after the date of the hearing.

Closer Trade Relations with Latin America

As the outgrowth of the Pan-American Financial Conference, Secretary of the Treasury McAdoo has appointed a number of prominent business men and financiers of the United States to act on committees which are to promote closer trade and other relations between the United States and Latin America.

Ten members, including Secretary McAdoo, will constitute an International High Commission, authorized by the conference to deal with uniformity of legislation in Pan-American countries, including laws on trademarks, patents and copyrights; bills of exchange, commercial paper and bills of lading; uniform classification of merchandise, customs regulations, port charges, etc.

The Secretary appointed a committee of eleven gentlemen, who are charged with the duty of arranging a visit to South and Central American countries by business men and financiers of the United States. At the recent conference, recalling the appropriation by the United States government of $50,000 for the entertainment of the foreign delegates, the Uruguayan delegation, after conference with the other foreign delegates, obtained the passage of a resolution inviting United States business men and financiers to make a return visit to South and Central American countries as the guests of those nations. The committee appointed by Secretary McAdoo to arrange such a visit is headed by Mr. James A. Farrell, president United States Steel Corporation, as chairman, and the other members are Messrs. S. T. Henry, second vice-president McGraw Publishing Company, Inc.; John Barrett, director-general Pan-American Union; D. P. Black, president Chamber of Commerce, Pittsburgh; Elliott H. Goodwin, secretary Chamber of Commerce of the United States; W. S. Kies, National City Bank, New York; Robert H. Patchin, secretary National Foreign Trade Council; James J. Shirley, F. A. Gillespie Company, New York; Willard Straight, J. P. Morgan & Company, New York; Edwin Warfield, president Fidelity Trust Company, Baltimore, and John Clausen, Crocker National Bank, San Francisco.

Mr. McAdoo points out that it has been suggested that the International High Commission meet in Buenos Aires on Nov. 1, 1915. Each of the eighteen Latin-American countries represented at the recent Washington conference is to name nine members to the International High Commission, headed by the Minister of Finance of each country. It is believed that an itinerary for the proposed visit of business men and financiers to South and Central America can be arranged which would put them in Buenos Aires on that date.

It is expected that the invitations to visit South and Central American countries as the guests of those nations will be issued principally to those who compose what Secretary McAdoo has called the permanent group conference committees. Mr. McAdoo, in selecting these permanent committees, has included a number of men known in the electrical industry. Among these are:

Argentina: Messrs. James A. Farrell, president United States Steel Corporation; Henry Ford, president Ford Motor Company; Frank A. Vanderlip, president National City Bank, New York.

Brazil: Mr. E. W. Rice, Jr., president General Electric Company.

Colombia: Mr. Maurice Coster, export manager Westinghouse Electric & Manufacturing Company.

Ecuador: Messrs. E. M. Herr, president Westinghouse Electric & Manufacturing Company, and J. G. White of J. G. White & Co.

Honduras: Mr. H. B. Thayer, president Western Electric Company.

Pacific Power & Light Employees Buy Stock

The Pacific Power & Light Company of Portland, Ore., issued recently a small amount of 7 per cent preferred stock and gave an opportunity to employees to subscribe for a limited amount. The plan provided that an employee or his wife, but not both, could subscribe for five shares or less at the par value of $100 per share, with a further special privilege of paying there-

STOCK TAKEN BY PACIFIC POWER & LIGHT EMPLOYEES

Branch	Number of Employees	Number of Shares	Average Number of Shares per Employee
Astoria	29	39	1.3
Vancouver	4	13	3.3
Hood River	10	28	2.8
White Salmon	4	11	2.8
Goldendale	4	..	...
The Dalles	12	11	0.9
Pendleton	10	12	1.2
Walla Walla	32	40	1.3
Waitsburg	2	2	1.0
Dayton	4	10	2.5
Pomeroy	3	7	2.3
Lewiston	8	5	0.6
North Yakima	37	41	1.1
Toppenish	5	22	4.4
Sunnyside	8	5	0.6
Prosser	4	5	1.2
Pasco	19	18	1.0
Naches power department	14	32	2.3
Kennewick power department	9	14	1.5
Walla Walla power department	11	12	1.1
Portland office and auditing departments	44	74	1.7
Total	273	401	1.5

for in monthly instalments of $2.50, the sum of $5 per share to be paid as a first payment. The amount of stock subscribed at the different branches and departments in relation to the number of employees in each is as shown in the accompanying table.

PACIFIC GAS & ELECTRIC COMPANY

Financial Development and Physical Growth of the Property—Sale of First Preferred Stock to Consumers

The conspicuous position occupied by the Pacific Gas & Electric Company on the Western coast and its rank as one of the very largest electric central-station companies in the country make a review of its operations timely. The company was incorporated in California on Oct. 10, 1905, as a consolidation of various properties. The constituent properties had in 1904 gross revenues of $7,490,509, in 1905 of $8,728,350, in 1906 of $8,947,162. There has been a steady increase in the gross operating revenue of $16,912,688, reported for the calendar year 1914, nearly double the total in the year of organization. This has been accomplished by consistent development in all departments. The gas business, however, has grown more rapidly in proportion to its beginnings than the electric business.

Where 56 per cent of the total gross revenue was received from sales of electrical energy in 1907 and 36 per cent from gas, the statistics for 1914 show 50.9 per cent for electrical energy and 40.7 per cent for gas. From 1907 to 1914 gross revenue from sales of electrical energy increased 38.7 per cent as compared with 71.7 per cent for gas. This is owing largely to the development of a larger market for gas for industrial purposes and for residence heating in the mild climate prevailing in California. It is expected that the use of electrical energy for industrial purposes will be increased very largely when the new hydroelectric developments of the company are in operation. From these developments the company will be enabled to increase greatly its sales of water for irrigation purposes, with, of course, incidental increase in the sales of energy for the operation of motors in irrigated districts. Of the total revenues, in addition to the expenditures named for electricity and gas, about 4 per cent is received from railway operation and 5 per cent from all other sources. Electric and gas interests combined have maintained from 1907 to the present about the same proportion of the business, a little over 90 per cent.

Increases in Consumers

Similarly, consumers have increased rapidly with the gains in revenues. Where in 1907 there were 54,772 electric consumers the total reached 148,957 in 1914, a gain of 172 per cent. In 1907 there were 122,304 gas consumers and in 1914 220,360, a gain of 80.2 per cent. Electric consumers in 1914 yielded $58.80 gross revenue on the average as compared with $31.84 for gas consumers and an average of $44.65 for electric, gas, water and steam consumers. The extent of the territory served is shown by the statement that the company operates in thirty counties in central California containing the most closely settled sections of the State, including San Francisco, Sacramento, Berkeley, Oakland, San José, Fresno and Stockton. The population of the cities and towns served is 1,288,123, and the highly developed State of California industries and the great growth of urban population are strong indications of an existing and potential market that promises much for the future.

Electric service is furnished to 152 cities and towns directly and to 62 indirectly, a total of 214. The territory served by the company is approximately 37,000 square miles in area and had, according to the 1910 census, a total population of 1,325,000, or 55 per cent of that of the State as a whole. Since that census was taken the increase in population has been steady. For the population of the counties served in 1910 the company showed average gross earnings in the year of $10.60 per inhabitant.

Diversified Sources of Revenue

The widely diversified sources of revenue in the electric part of the business are shown from the following classification for 1913: Commercial and residential business, $3,642,837, or 44.3 per cent of the total; State, county and municipal business, $662,566, or 8 per cent; agricultural industry, $419,093, or 5.1 per cent; mining industry, $557,462, or 6.8 per cent; transportation industry, $696,324, or 8.5 per cent; manufacturing industry, $1,476,104, or 17.9 per cent; other electric light and power corporations, $343,430, or 4.2 per cent; "commercial and miscellaneous," $431,337, or 5.2 per cent; temporary lighting and motor service, $1,628.

While the actual number of hydroelectric plants has undergone little change from year to year, the aggregate rating installed increased from 75,200 hp in 1906 to 123,740 hp in 1913, or an increase of 64.5 per cent. The number of steam electric plants has decreased, but the installed rating of these plants increased from 42,315 hp in 1906 to 110,188 hp in 1913, or 160.4 per cent. The total number of generating plants, which was fifteen in 1906, was fourteen in 1913. The aggregate rating increased from 1906 to 1913 99.1 per cent. In 1906 there were 3715 street arc lamps in service, while in 1913 the total was 6721, an increase of 80.8 per cent. In 1906 there were 2494 street incandescent lamps, while in 1913 the total had increased to 21,321, or a gain of 754.9 per cent. The latest statistics published show that the total length of transmission and distribution lines was 5090 miles. The diversity of distribution is shown by the fact that, according to the 1913 report, the company was supplying energy at the close of that year to 115 separate types of industries engaged in agriculture, mining, manufacturing and transportation. Eleven electric railways, operating a total of 594 miles of road, obtained energy from the plants of the company.

Hydroelectric Additions

To provide for the large development of which its officials feel absolutely confident in the future the company is constructing hydroelectric additions of great importance. The development on the South Yuba and Bear Rivers, on which the company owns valuable water-power rights, will furnish an ultimate supply of 190,000 hp. In this development six power houses will use the same water and the water will then be used for irrigation, which will be made much more of a feature of the operations than in the past. The extent of the dependence of the company upon steam electric stations is shown by the fact that such plants with modern equipment are in four of the larger cities served, San Francisco, Oakland, Sacramento and San José. Statistics given out by the company to indicate the efficiency attained in the use of fuel oil in the operation of the steam plant at San Francisco show that the number of kilowatt-hours obtained per barrel of oil has improved as follows: In 1907, 133.49; in 1908, 139.01; in 1909, 152.19; in 1910, 158.50; in 1911, 201.08; in 1912, 207.76; in 1913, 217.68.

The rate of increase in revenue of all departments of the company has been greatly in excess of the rate of increase in population during a period of ten years. From 1904 to 1913 the increases were approximately as follows: In population served, 30 per cent; revenue in electric department, 130 per cent; in gas department, 90 per cent; in railway department, 108 per cent; all departments combined, 116 per cent.

The net cost of additions to the plant, representing the total cost less the value of any property replaced, have been as follows in the years stated: In 1906, $3,860,244; in 1907, $3,688,475; in 1908, $2,099,996; in 1909, $1,746,706; in 1910, $3,404,298; in 1911, $6,802,-

158; in 1912, $7,821,712; in 1913, $9,091,192; in 1914, $2,734,000; total for the period stated, $41,248,781.

Selling Stock Direct to Consumers

Recent financing of the company has attracted widespread attention from public utility officials and bankers. The company has been entirely successful in selling first preferred stock to consumers. It has thus overcome the difficulties of obtaining capital from the usual banking channels since the commencement of the war in Europe. The action of the company in marketing directly with investors so large an amount of its first preferred stock as the total of about $9,000,000 thus sold would have been regarded as remarkable even under normal conditions.

The plan of the company to create a new issue of first preferred stock received the approval of the Railroad Commission of California on July 1, 1914. The opinion, written by one of the members and approved by the committee, said: "Applicant's plan to sell its new first preferred stock appeals to me as thoroughly sound and commendable. The plan is in accord with suggestions for junior financing which have been made by this commission from time to time to various public utilities and is worthy of emulation in so far as applicable by other utilities."

To call attention to the offering of the company, separate circulars, dated July 24 and Aug. 15, 1914, respectively, addressed "To our consumers," were mailed to about 170,000 individual customers. The circular of July 24 stated that the Railroad Commission had authorized the company to sell the stock at a minimum price of $82.50 per $100 share, yielding 7.27 per cent. In accordance with an implied requirement of the law, this stock was offered first to existing stockholders, who subscribed for a large proportion. The offering was also extended to employees, of whom 1425, or about 40 per cent of the permanent staff, had become shareholders on July 24, 1914. In the circular Mr. John A. Britton, vice-president and general manager of the company, stated:

"A number of our consumers have requested the privilege of joining in this subscription, thus obtaining an opportunity of sharing in the profits of the company and possessing a voice in its management. Believing it to be to the advantage of the company as well as its consumers that the stock should be distributed to as large an extent as possible among the representative citizens of California who are our consumers, the directors of the company hereby extend an invitation to all consumers to purchase a portion of the stock."

Subscribers were given the opportunity to pay in full or in instalments, upon the same terms in all respects which were offered to old stockholders and employees. The stock is free of tax in California, and the income therefrom is not subject to the normal federal income tax. It is issued as fully paid with the express covenant of the company that it shall not be subject to assessment for any purpose. Dividends are cumulative. Mr. Britton said:

Security Behind the Issue

"Its security rests upon a property of large value serving, with gas, electricity and water, constituting every-day necessities, the population of a territory which is large, constantly growing, and with which our consumers are perfectly familiar. Every share of the new stock has back of it more than $100 of property value. This stock also has preference over other stock issues of the company which have a present-day market value in excess of $20,000,000.

"The property has a large, well-proved and increasing earning capacity. It is a well-recognized fact that business depressions have little influence on the earnings of public utilities of this character. In every one of the eight years since the organization of the company its earnings have been largely in excess of the amount of the annual dividend on this stock, and the margin of safety during the past five years has been so large as to leave no doubt of the ability of the company to pay the dividends on this stock regularly.

"The stock will have a recognized market value, thus making it available for ready cash sale or as security for loans."

Mr. Britton added that the management had no hesitancy in stating that it regards the first preferred stock as an investment security of the highest character and one which it can recommend to consumers with the utmost confidence that their investment will be safe and should increase in value.

EARNINGS—THREE MONTHS ENDED MARCH 31

	1915	1914	Increase	Per Cent Increase
Gross operating revenue	*$4,749,327	$4,342,576	$406,751	9.4
Deduct maintenance, operating expenses, taxes and reserves for uncollectible accounts and casualties	2,290,725	2,237,961	52,764	2.4
Net earnings from operation	$2,458,602	$2,104,615	$353,987	16.8
Add profit on merchandise sales and other miscellaneous income	71,314	98,362	†27,048	†27.5
Total net income (before depreciation)	$2,529,916	$2,202,977	$326,939	14.8
Bond interest	950,932	959,107	†8,175	†0.9
Balance	$1,578,984	$1,243,870	$335,114	26.9
Interest on one-year notes and floating debt (temporary)	116,341	112,059	4,282	3.8
Balance	$1,462,643	$1,131,811	$330,832	29.2
Bond discount and expense	36,958	36,913	45	0.1
Balance	$1,425,685	$1,094,898	$330,787	30.2

*Including $101,539 in litigation. †Decrease.

Instalment Plan of Purchase

Subscribers buying on the instalment plan remitted with their subscription $5 per share and pay the remaining $77.50 in instalments spread over the fifteen months ending Oct. 1, 1915. Interest at 6 per cent per annum is paid on instalments from the dates they are reecived by the company or its agent until the full subscription price is paid and the certificates are issued. Payments may be anticipated. Ninety-three banks in fifty-seven cities in the territory served received subscriptions and payments, which may also be made at any business office of the company.

A letter sent by Mr. A. F. Hockenbeamer, second vice-president and treasurer, to an inquiring investor was also given publicity. Mr. Hockenbeamer showed the development in earnings and the large margin of security protecting the dividend requirements. The letter was published in connection with a circular dated Oct. 15, 1914, which included a letter signed by Mr. Frank G. Drum, the president. This circular was distributed in a more limited way and more especially among those who had asked for further information in regard to the issue.

The public interest displayed in the action of the company and the increasing subscriptions by Pacific Coast residents lead the company officials to believe that there will always be a demand for this security by local California investors.

115,000-Volt Hydroelectric System in Japan—II

Transmission Lines and Receiving Substation of the Inawashiro Plant—Outdoor Sectionalizing and Cross-Connecting Stations—A 1530-Ft. Span of Steel Conductors

AS mentioned in the first instalment of this article, two transmission circuits supported on a single set of steel towers extend from the hydroelectric station at Lake Inawashiro to the receiving station at Tokio, a distance of 145 miles. The right-of-way is sufficiently wide, however, to accommodate another line of double-circuit towers.

Dividing the existing line into four sections are three equally spaced, outdoor-type, sectionalizing stations. Switching equipment is provided at each such station for tying together or cross-connecting any two lines. These stations may also be easily extended to accommodate the second pair of lines which may be installed at some future period.

Transmission-Line Construction

The transmission line follows the main highway from Wakamatsu, near Lake Inawashiro, to Tokio very closely, and throughout practically the entire length the right-of-way is paralleled by railroad. The circuits cross rice fields and several rivers, among which are the Tone, Hoki, Kinu, Ara, Abukuma, Haniw and Sabi. The standard towers are 72 ft. high and are set about 550 ft. apart. One circuit is supported on each side of the tower, with the conductors at the apexes of flattened triangles having adjacent sides vertical. Conductors lying in the same vertical plane are 240 in. apart, while the third conductor is equidistant from the other two and 27 in. from a plane passing through them. Each conductor consists of seven copper strands wrapped around a copper core and has a conducting cross-section of 197,568 circ. mils. Supporting the conductors are seven section specially designed Thomas suspension-type insulators. Two $\frac{3}{8}$-in. steel guard wires—or ground wires, as they are usually called—are supported above each circuit. Additional protection against lightning is afforded by electrolytic-cell lightning arresters at the generating, intermediate and receiving stations. Data regarding the special towers and arrangement of conductors thereon are given in the accompanying tables. A 1530-ft. span is required over the Tone River near one of the switching stations. For this purpose special 220-ft. towers are employed. Each conductor consists of $\frac{5}{8}$-in. seven-strand steel cable and is anchored at its ends by three groups of eight-section insulators connected in parallel.

Telephone System

Parallel to but about 700 ft. from the transmission line is a three-circuit telephone line. One circuit is for direct communication between the generating station and the receiving station. The second is divided into two sections at the middle outdoor switching station and can be interconnected with either of the other circuits. Circuit No. 3 is divided into four sections by equipment at each of the outdoor stations.

The circuits are supported on impregnated nara-wood cross-arms attached to 24-ft. sugi-wood poles placed about 180 ft. apart. The conductors are made of No. 9 hard-drawn copper, and the insulators, which have double petticoats, are made of porcelain. One No. 8 Roebling-gage galvanized-iron wire is attached to the top of each pole and grounded at every connection. On very long spans, such as across rivers, etc., special poles and copper-clad steel wire are used. To protect the telephone instruments and persons using them, telephone transformers, drainage coils, lightning arresters, fuses and heat coils are employed.

Sectionalizing and Cross-Connecting Equipment

Each sectionalizing station consists of a structural steel platform supported about 10 ft. above the ground on six steel towers which extend above the platform and

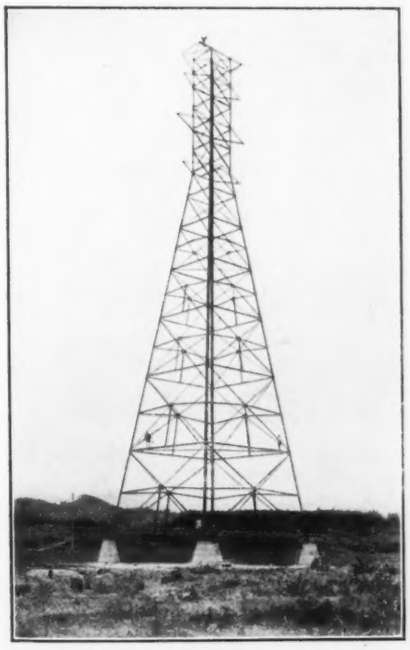


FIG. 1—160-FT. TOWER AT HOKI RIVER CROSSING

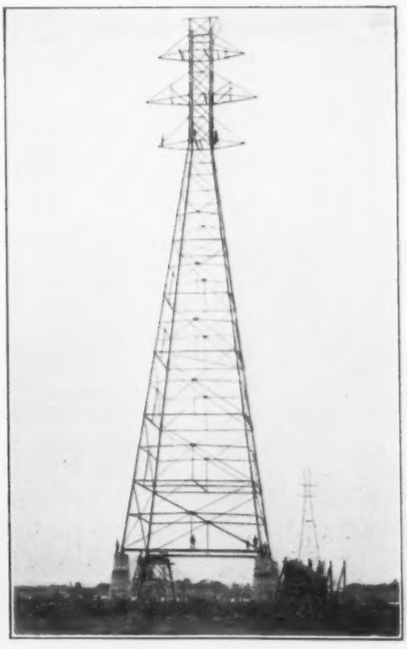


FIG. 2—220-FT. TOWER EACH SIDE OF TONE RIVER

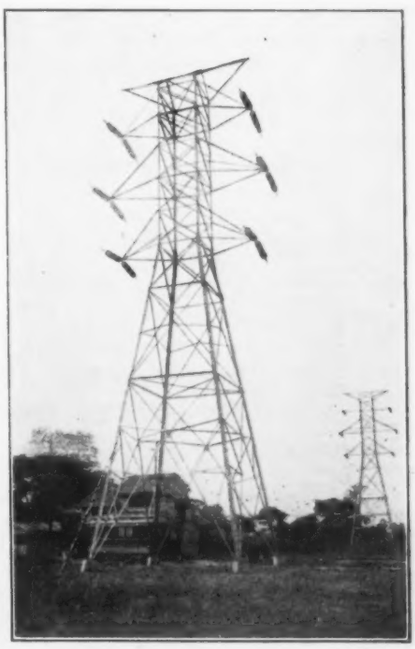


FIG. 3—TYPE OF TOWERS ON EACH SIDE OF RAILWAY CROSSINGS

support horizontal trusses to which the incoming and outgoing transmission lines are anchored. From the incoming and outgoing circuits of each transmission line conductors run to horn-gaps and thence to the same electrolytic lightning arresters on the platform. The lightning arresters, each set of which consists of four single-phase units, are arranged in a single row across the platform. The incoming-circuit and outgoing-circuit horn-gaps flank both sides of the arresters.

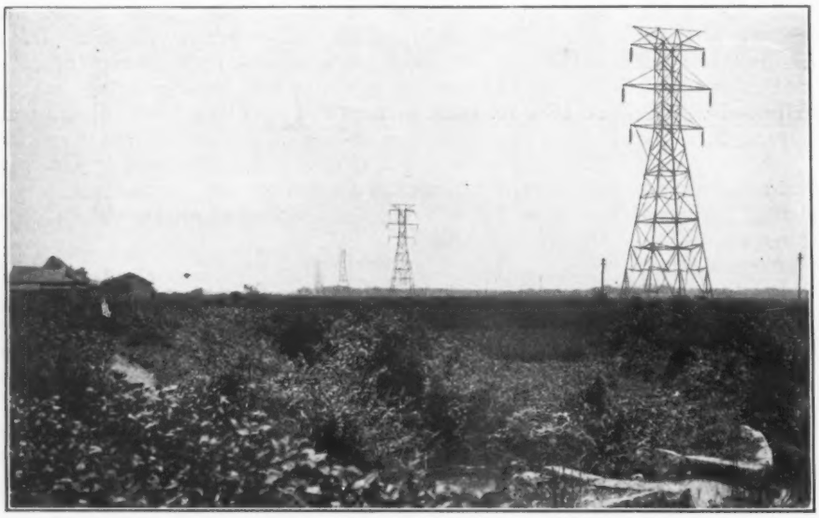


FIG. 4—150,000-VOLT TRANSMISSION LINE OF THE INAWASHIRO HYDROELECTRIC POWER COMPANY, JAPAN

Other conductors drop from the incoming and outgoing circuits to a level below that of the platform and are joined by circuits passing under the platform through oil switches and isolating disconnecting switches. The oil switches are similar to the 115,000-volt oil switches installed in the generating station, except for their terminals and details of their control. As shown by the accompanying illustration (Fig. 12), the terminals are covered with a series of porcelain insulators. The space between the bushing and the porcelain shell is filled with a moisture-excluding compound. The mechanism is operated by hand, but series transformers are placed around the terminals inside the tanks and connected with time-limit relays to afford automatic release.

To cross-connect the transmission circuits additional disconnecting switches are provided so that any set of "drop" lines can be connected with transfer busbars arranged in a vertical plane and strung across the right-of-way on the incoming and outgoing sides of the station. The transfer busbars can be connected with each other by circuits passing through oil switches installed on the ground at one end of the sectionalizing station. The transfer busbars are strung between triangular steel towers and are supported at intermediate points by suspension-type insulators attached to cantilever trusses projecting from the platform.

Arrangement of Equipment in Receiving Station

The receiving station is laid out so that the ultimate arrangement of equipment on each side of any center line will be similar but reversed. When the two contemplated transmission lines are erected, about double the equipment now employed will be installed to care for the additional energy which will be supplied and distributed. When this is done, the transformers, busbars, switches, etc., will lie in a loop—both physically and electrically speaking.

Referring to the existing installation, the transmission lines, two in number, approach the receiving station on the long side where they are anchored and connected with choke coils, horn-gaps, electrolytic lightning arresters, and lines leading inside the station.

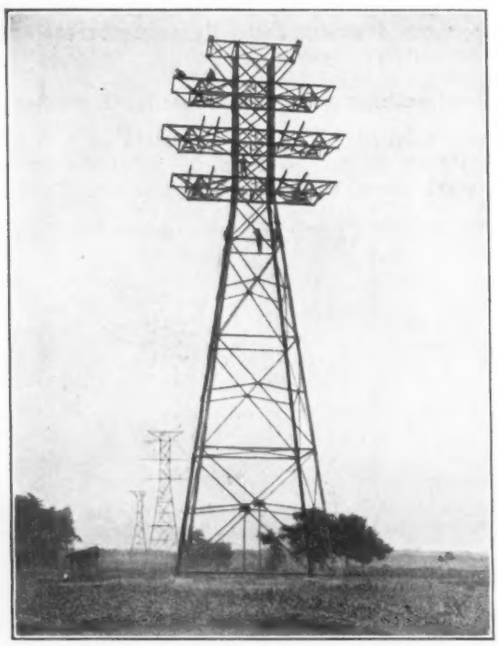


FIG. 5—108-FT. TOWER FROM WHICH LINES RISE TO 220-FT. TOWERS

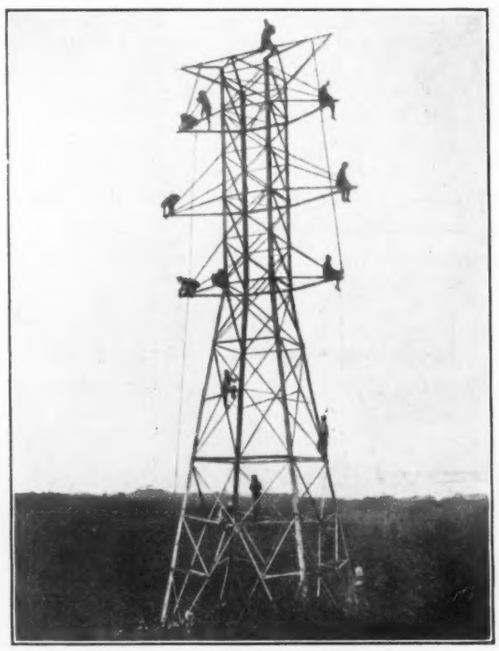


FIG. 6—ANCHOR TOWER AS IT APPEARED DURING PROCESS OF CONSTRUCTION

All of the equipment so far installed is arranged in the shape of the letter U. The same method of suspending busbars and disconnecting switches is employed as was described for the generating station. Three sets of high-voltage oil switches are symmetrically placed in each half of the U. Two switches and their isolating disconnecting switches are in series with the incoming transmission lines, while the remaining four are connected between the busbars and four banks of step-down transformers. A set of three single-pole oil switches isolated by disconnecting switches divide the busbars in two sections. Conductors extend from the transformer oil switches to built-up insulators projecting from the wall and thence downward through openings in the floor to the four banks of transformers.

Each bank of transformers consists of three 4000-kva, single-phase, 100,000/11,000-volt delta-connected, oil-insulated, water-cooled transformers. In construction these units are the same as those employed at the generating station, their rating, of course, being lower because of the lower receiving voltage. The units are arranged in two rows of individual masonry compartments which face each other. When the transformers need overhauling the trucks supporting them can be run out into the aisle separating the compartments and a crane employed to transport the units to the workshop.

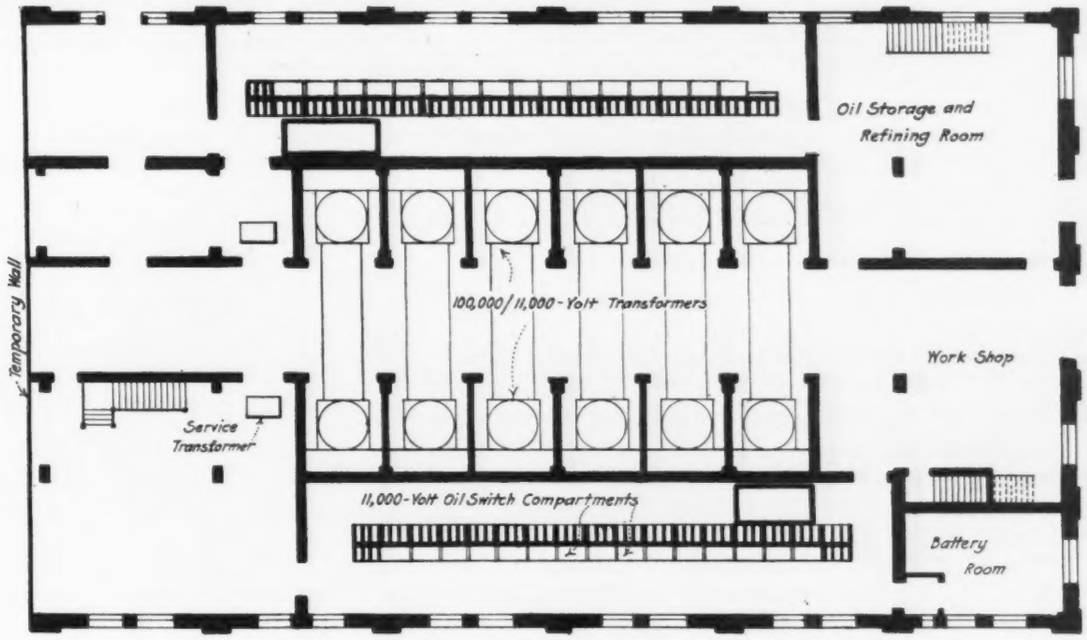


FIG. 7—PLAN OF TRANSFORMER FLOOR IN RECEIVING STATION

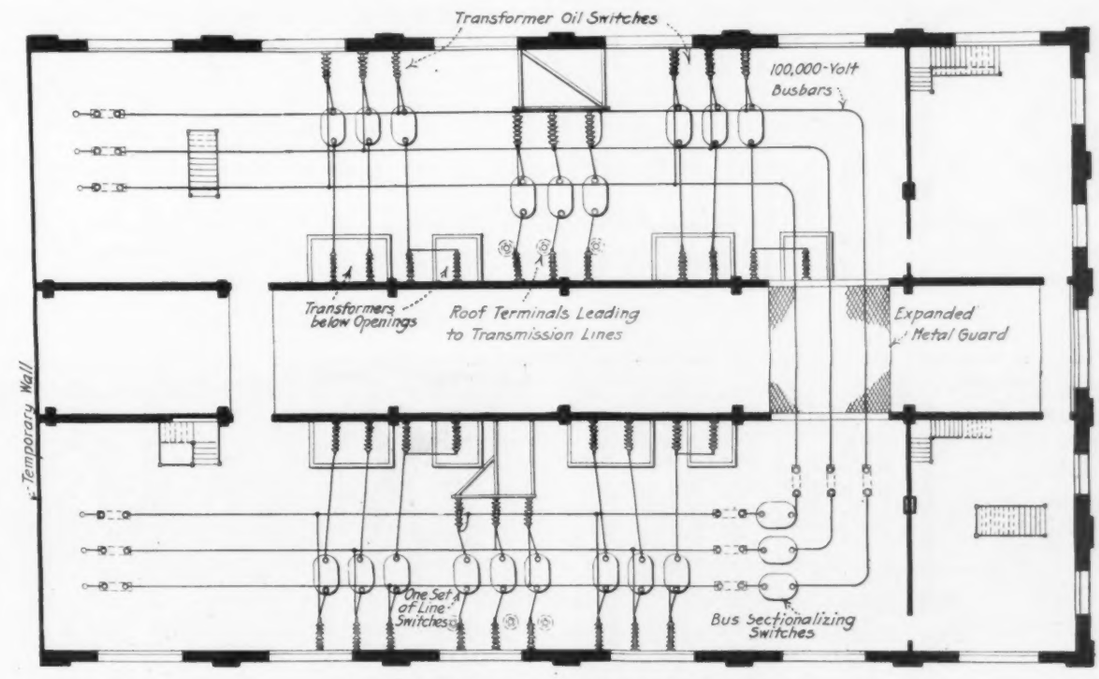


FIG. 8—PLAN OF HIGH-VOLTAGE GALLERY

11,000-Volt Equipment

Back of each row of transformers are two galleries. On the upper one are 11,000-volt busbars and the choke

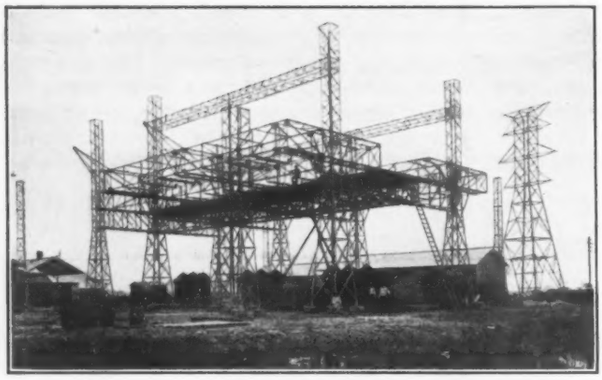
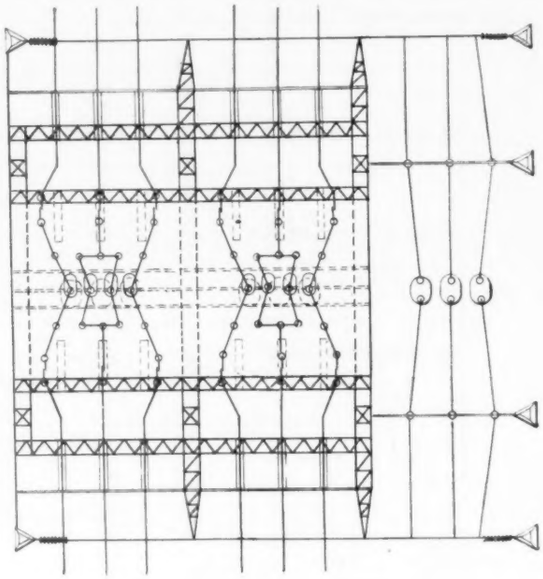


FIG. 9—ONE OF THE OUTDOOR SECTIONALIZING STATIONS BEFORE COMPLETION

coils, horn-gaps and electrolytic lightning arresters attached to outgoing 11,000-volt feeders and tie lines. The auxiliary and main busbars on each side of the building are respectively connected by cables, having disconnecting switches at each end. In the circuit connecting the main busbars is also an oil switch. Further flexibility of operation is afforded by bus-tie oil switches and disconnecting switches joining auxiliary and main busbars on the same side of the building.

At present there extend from the receiving station four 400-amp and four 800-amp, 11,000-volt feeders and two 800-amp, 11,000-volt tie lines connecting with other substations in Tokio. Each of these feeders can be connected with either the main or auxiliary busbars. Protection against disturbances on these lines is afforded by electrolytic lightning arresters, horn-gaps and choke coils installed on the 11,000-volt busbar gallery.

Energy for the station-service transformers, of which there are two rated at 150 kva each, can also be taken from either set of busbars. These transformers are connected with 220-110-volt busbars which feed the station lamp and motor circuits and two motor-generator sets used in charging the switch-control battery. The station lamps operate on 110 volts, while the motors are designed for 220 volts and start on 110 volts.



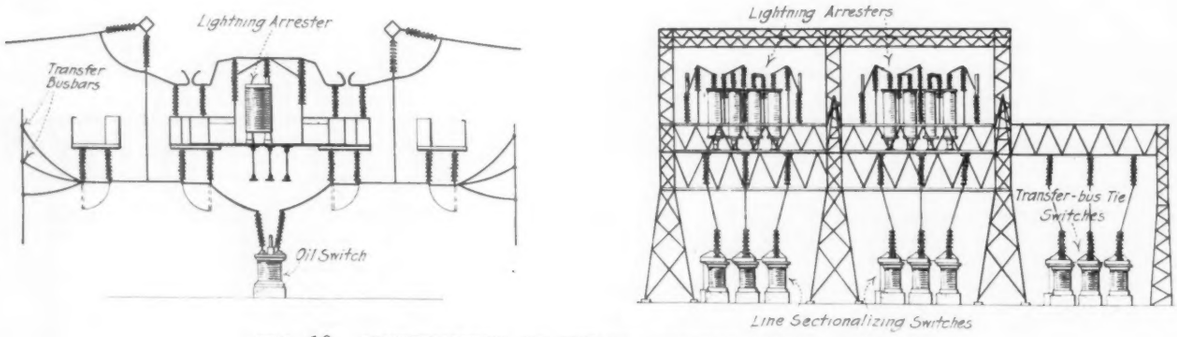


FIG. 10—CONSTRUCTION OF OUTDOOR SECTIONALIZING STATION

Control Equipment

The main control board lies at one end of the build-

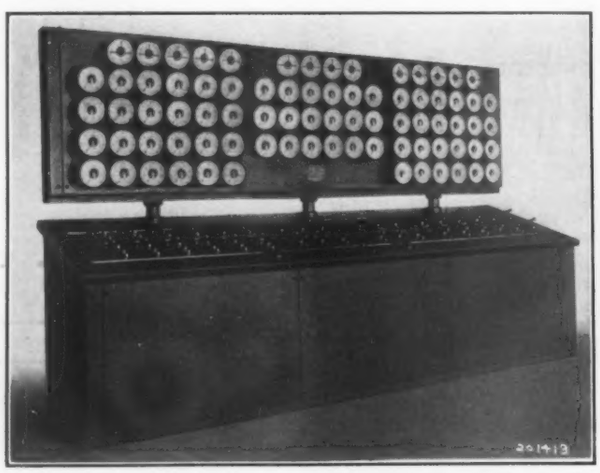


FIG. 11—MAIN CONTROL BOARD IN RECEIVING STATION

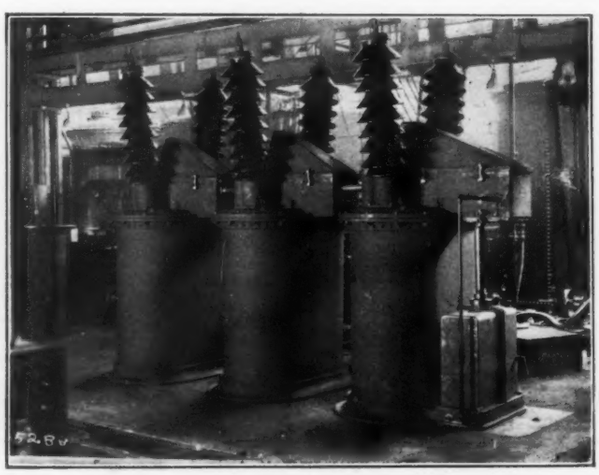


FIG. 12—OIL SWITCHES FOR SECTIONALIZING STATIONS

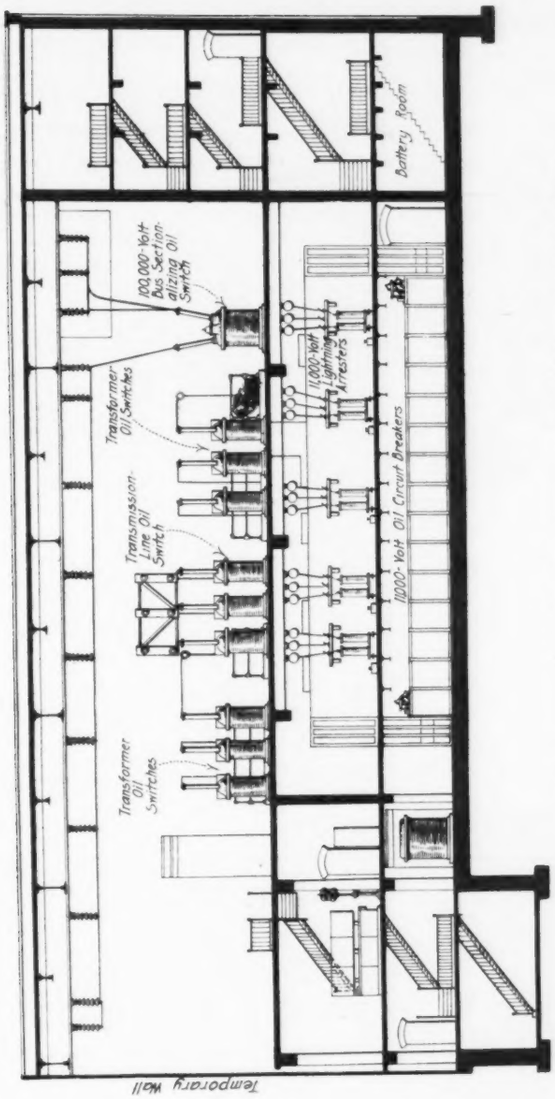


FIG. 14—CROSS-SECTIONS OF 100,000-VOLT AND 11,000-VOLT GALLERIES

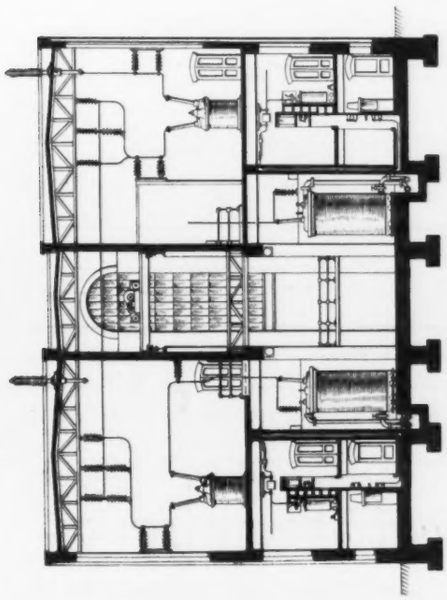


FIG. 13—CROSS-SECTION OF RECEIVING STATION

ing on the same level as the 11,000-volt busbar gallery. This position was chosen because it will be centrally situated when the station is extended to its ultimate size. The board, which is of the desk type, consists of three sections. The central one contains apparatus controlling the incoming-circuit switches, the main transformers and the bus-tie switches; the two end sections

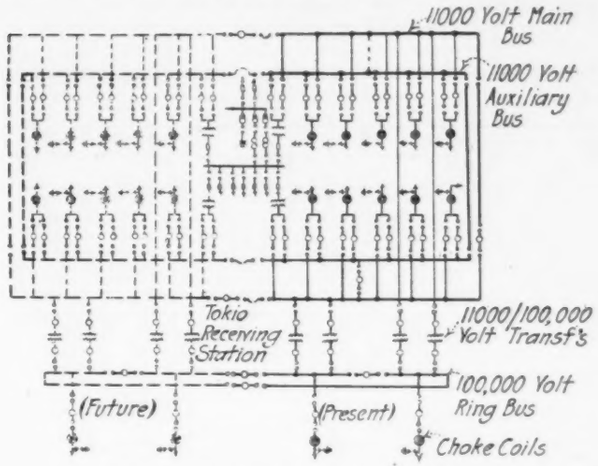


FIG. 15—DIAGRAM OF CONNECTIONS

control local service circuits and 11,000-volt feeders and tie lines. On the inclined top are miniature dummy busbars indicating the connection and position of switches. The 11,000-volt circuits are indicated by a copper finish and the high-voltage circuits by nickel finish. The 115,000-volt ammeters, which are connected with series transformers around the oil-switch termi-

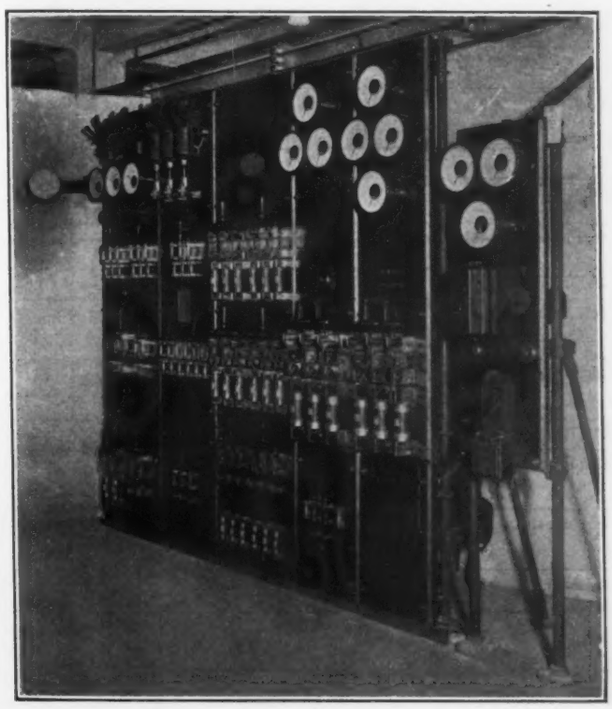


FIG. 16—STATION SERVICE BOARD AT SUBSTATION

nals, have red dials to distinguish them from low-voltage instruments.

Relays, watt-hour meters and graphic instruments are on another board near the main control board. Recording watt-hour meters equipped with double registers operated by ratchets are employed in the substation tie lines to show when energy is being delivered

EQUIPMENT OF INAWASHIRO (JAPAN) 115,000-VOLT HYDROELECTRIC SYSTEM

TRANSMISSION SYSTEM

Termini of Conductors	Topography of Route	Disturbances Subjected To	Distance of Transmission	Number and Spacing of Sectionalizing Stations	Provision for Future Lines
Lake Inawashiro to Tokio..	Cross rice fields, rivers and some mountains	Earthquakes	145 miles	3, equally spaced	Space for another two-circuit tower line

CONDUCTORS					INSULATORS			
	Material	Cross-section	Number Strands	Material of Core		Sections	Type	Manufacturer
Normal span	Copper	197,568 circ. mils	7	Copper	Standard	7	Suspension	R. Thomas
Long span	Steel	5/8 in. dia.	7	Steel	Standard	8	Suspension	R. Thomas

TOWERS					CONDUCTORS		
Location	Spacing (Ft.)	Number and Height of Towers	Dimensions of Base	Maximum Uplift (Lb.)	Arrangement of Conductors	Spacing	Position of Ground Wires
Generating station	570	Two, 59 ft.	12 ft. x 20 ft.	30,000		24 ft. between ext. outside conductors	None
Straight line	550	1121, 72 ft.	18 ft. 8 in.	27,000		19.5 ft. hor. min. 23.5 ft. hor. max. 10 ft. vertical	4.9 ft. above upper conductor cross-arms, 19.5 ft. apart
Strain and at turns exceeding 30 deg	15,400	109, 72 ft.	19 ft. 7 in.	.....	Do.	20.5 ft. hor. min. 24.5 ft. hor. max. 10 ft. vertical	8 ft. above conductors, 20.5 ft. apart
Angle (6 to 30 deg)		175, 72 ft.	19 ft. 7 in.	38,000	Do.	Do.	Do.
Tone River	1530	Three, 219.5 ft.	50 ft.	84,000		25 ft. hor. min. 35 ft. hor. max. 20 ft. vertical	15 ft. above conductors, 15 ft. apart
Tone River	1530	Two, 108 ft.	29 ft.	105,000	Do.	22 ft. hor. min. 26 ft. hor. max. 10 ft. vertical	10 ft. above conductors, 18 ft. apart
Tone River	480	One, 100 ft.	25 ft. 4 in.	67,000	Do.	20.5 ft. hor. min. 24.5 ft. hor. max. 10 ft. vertical	8 ft. above conductors, 20.5 ft. apart
Haniw River	795	Two, 106 ft.	27 ft.	68,000	Do.	Do.	Do.
Abukuma River	870	One, 79 ft. One, 96.5 ft.	24 ft. 5 in. 24 ft. 5 in.	71,000 71,000	Do.	Do.	Do.
Ara River (near Tochigi)	870	One, 79 ft. One, 96.5 ft.	24 ft. 5 in. 24 ft. 5 in.	71,000 71,000	Do.	Do.	Do.
Ara River (near Tokio)	950	Four, 124.5 ft.	32 ft.	72,000	Do.	Do.	Do.
Hoki River	1320	Two, 160.5 ft.	44 ft. 2 in.	70,000	Do.	25 ft. hor. min. 30 ft. hor. max. 15 ft. vertical	10 ft. above conductors, 20 ft. apart
Hoki River	1320	Two, 72 ft.	17 ft. 10 in.	60,000	Do.	20.5 ft. hor. min. 24.5 ft. hor. max. 10 ft. vertical	8 ft. above conductors, 20.5 ft. apart
Kinu River	1290	Two, 72 ft.	17 ft. 10 in.	60,000	Do.	Do.	Do.
Kinu River	1290	Two, 132.5 ft.	36 ft.	71,000	Do.	25 ft. hor min. 30 ft. hor. max. 15 ft. vertical	10 ft. above conductors, 20 ft. apart
Kinugawa Hydroelectric Company Crossing	348	Two, 100 ft.	25 ft. 4 in.	67,000	Do.	20.5 ft. hor. min. 24.5 ft. hor. max. 10 ft. vertical	8 ft. above conductors, 20.5 ft. apart
Sabi River, 35 deg. angle	684	Two, 82.5 ft.	20 ft. 8 in.	80,000	Do.	Do.	Do.

110,000-VOLT SWITCHES

No. Sets	Rating (Amp)	Type	Location	Relay Type
2 2 2	300	Disconnecting Oil Disconnecting	Transformer line to busbars	Overload, R. P. I. T.
1 1 1	300	Disconnecting Oil Disconnecting	Sectionalize busbars	Overload I. T.
4 4	300	Disconnecting Oil	Bus to transformer	Overload I. T. Differential

EQUIPMENT OF INAWASHIRO (JAPAN) 115,000-VOLT HYDROELECTRIC SYSTEM

11,000-VOLT SWITCHES

No. Sets	Rating (Amp)	Type	Location	Relay Type
4 4	1200	Oil Disconnecting	Between transformers and main 11,000-volt bus	Overload, I. T. Differential
1 3	1200	Oil Disconnecting	Sectionalize main 11,000-volt busbars	Overload, I. T.
2	1200	Disconnecting	Sectionalize auxiliary 11,000-volt bus	Overload, I. T.
2 2 2	1200	Disconnecting Oil Disconnecting	Tie each half of main bus with corresponding half of auxiliary bus	Overload, I. T.
4 4 4	1200	Disconnecting Oil Disconnecting	Between main busbars and four 800-amp feeders	Overload
4 4 4	1200	Disconnecting Oil Disconnecting	Between auxiliary busbars and same feeder	Overload
4 4 4	600	Disconnecting Oil Disconnecting	Between main busbars and four 400-amp feeders	Overload
4 4 4	600	Disconnecting Oil Disconnecting	Between auxiliary busbars and same feeders	Overload
2 2 2	1200	Disconnecting Oil Disconnecting	Between main busbars and two 800-amp tie lines	Overload, R. P.
2 2 2	1200	Disconnecting Oil Disconnecting	Between auxiliary busbars and same tie lines	Overload, R. P.
2 2 2	600	Disconnecting Oil Disconnecting	Between main busbars and two service transformers	
2 2 2	600	Disconnecting Oil Disconnecting	Between auxiliary busbars and same transformers	

TRANSFORMERS

No.	Kva	Phases	Voltage		Connections		Type	Manufacturer	Purpose Used for
			Low	High	Low	High			
12	4000	1	11,000	100,000	Δ	Δ	O. I., W. C	West.	Feed distribution system
2	150	3	220–110	11,000	Δ	Δ	O I., W. C.	West.	Station service

PROTECTIVE EQUIPMENT

No. Sets	Type	Manufacturer	Arrangement	Connected with	Location
2	Single-phase electrolytic cells with horn-gaps and choke coils	West	Three cells in star; neutral grounded through a fourth cell	115,000-volt transmission lines	Outdoor
10	Single-phase electrolytic cells with horn-gaps and choke coils	West.	Two cells across each three-phase circuit	11,000-volt feeders and tie lines	Indoor

110,000-VOLT BUSBARS

No. Sets	Arrangement	Rating (Amp)	Material	Connected with
1	Two-section, U-shaped, ultimately loop four section	300	0.75-in. copper tubing	Step-down transformer and two 115,000-volt, 300-amp transformer lines

11,000-VOLT BUSBARS

No. Sets	Arrangement	Rating (Amp)	Material	Connected with	Rating of Bus Reactors
1	Two-section U, ultimately Four-section loop	1200	Strap copper	Four 800-amp feeders Four 400-amp feeders Two 800-amp tie lines Two service trans.	None
1	Two-section U, ultimately Four-section loop	1200	Strap copper	Four 800-amp feeders Four 400-amp feeders Two 800-amp tie lines Two service trans.	None

or received. Potential taps for reverse-power relays are connected with the low-voltage side of the main transformers. The types of relays used in each circuit are indicated in the accompanying tables. Three annunciators are employed for the same purpose as mentioned in the description of the generating station.

The station-service switchboard is similar to that used at the generating station except that it controls two motor-generator sets used in charging the storage battery. Emergency lighting and signal-cell charging control are the same in the receiving and generating stations. Double-throw switches are connected with each motor-generator set and the storage battery so that one generator may be employed to supply energy for operating the oil circuit-breakers while the other set, running at approximately half-voltage, is being used to charge the storage battery with its two halves connected in parallel.

High-voltage testing apparatus is provided similar to that used at the generating station with the exception that the regulating transformer is energized from 11,000-volt instead of from 6600-volt busbars. The oil-circulating system and storage battery are practically duplicates of those employed at the generating station. As no exciters are available in the receiving station for charging the batteries, however, motor-generator sets were provided. The motors in these sets are of the induction type and are rated at 220 volts, 19 hp. They drive 12-kw, 250-volt generators.

DEPRECIATION ACCOUNTS

Consideration of the Method in Which They Should Be Kept —Lack of Uniform Terminology

BY WILLARD H. LAWTON

In accounting for depreciation there are two indispensable accounts and one optional account, namely:

Indispensable.—Depreciation Account—An expense account to which is debited current loss due to wear and tear, exhaustion, or obsolescence of physical property, and credited by closing into general operating expense or profit and loss. Depreciation Reserve Account—To which is credited concurrently the depreciation charged as above, and which is debited from time to time with the cost of replacing worn out, exhausted or obsolete physical property.

Optional.—Replacement Fund Account—Which is debited with the actual cash or other liquid assets set aside from general assets to pay for replacements of expired physical property at some future date, and credited with such payments when made.

The periodical depreciation charge is seldom based on actual ascertained depreciation, but on some theory which assumes that the unit depreciated will have to be replaced at a certain date more than one year in the future. A unit that requires replacement within a year is not, as a rule, depreciated in the accounting sense, the cost of replacing it being charged directly to repairs or current renewals. The depreciation charge is, therefore, usually a prorated amount according to the number of years of the assumed unit life, modified, of course, by the amount of "scrap value," if any, assumed to be left. This is basing depreciation on the "straight-line rule." There are several other methods, for instance, the "sinking-fund rule," by which, instead of charging and setting aside a flat amount per annum, we would charge annually only such amount as would with compound interest at an assumed rate amount to the total desired at the end of the estimated life. But, as in all valuations for rate-making purposes to date it is customary for public utility commissions to calculate depreciation by the "straight-line rule," it is advisable for public utilities to adopt the same rule in accounting for depreciation; otherwise their books will never show the same approximate present value of physical property as the commissions determine. For the sake of simplicity, the "straight-line rule" will be assumed in this paper.

The rate of depreciation having been assumed, the utility accountant will make periodical—annual, quarterly, monthly—entries in his journal as follows:

"Depreciation account to Depreciation reserve account: (Amount of depreciation estimated to have been experienced on physical unit from ——— to ———.)"

Just how the periodical amount is determined is immaterial so long as the total amount charged for the year is equal to the pro rata amount required by the assumed life of the unit. Where charges are made monthly or quarterly, it may be an assumed percentage of gross earnings or be based on the output per unit. The last method is usually the best as it makes the monthly or quarterly charge proportionate to the actual business.

Depreciation account, being one of those classified under operating expense (although in some states in the "shadowland" between operating expense and income deductions, like taxes or uncollectible bills), the total charged will, when the books are closed periodically, be balanced by profit and loss entries.

Depreciation reserve account is always an open one, its balance being carried forward from year to year. The balance should indicate the amount of depreciation estimated to have occurred which has not yet been made good by replacements. It should, therefore, always be a credit balance; if it shows a debit balance, the past depreciation charge has been inadequate. The difference between the balance of this account and the total of the plant cost account indicates the present net (depreciated) value of the plant. It may be well to add that while the balance of this account appears on the liability side of the balance sheet, it must not be considered as a liability in the ordinary sense. As its name indicates, it is a "reserve" account—i.e., it has been "reserved" from the general surplus for obvious reasons. Some accountants prefer to treat it as a subaccount under "surplus account" on the balance sheet. This is technically correct, but as few stockholders have the technical knowledge to understand such a statement, it is better to state it clearly, if untechnically, as a separate reserve account.

The entry which creates the reserve has already been given above. When a replacement is made the entry on the books will be:

"Depreciation reserve account to Accounts payable: (Cost of replacing unit so-and-so expired.)"

The principle and procedure of accounting for depreciation are thus clear and easy to understand. In practice there are so many irregular factors to be considered that it becomes very complicated. If replacement funds are invested, there will be the income which tends to make the fund larger than will be required ultimately. If funds are used for additions and extensions, there will be the problem of how far it is safe so to use them. If the unit life proves longer or shorter than estimated, innumerable adjustments will be necessary to keep operating expense uniform in respect to depreciation. All we can say here is that if the estimated life and value of residual "scrap" prove correct, and the cost of replacement the same as that of the original unit, the above entries will furnish a complete financial history of the unit, in connection, of course, with the record of the original cost charged to plant account.

It is to be regretted that there is so little uniformity in terminology of depreciation accounts. Using different titles for the same account causes no end of un-

necessary confusion and disputes. The writer remembers with some amusement a waste of two hours of a convention's time by two hot-headed utility accountants who were in really practical agreement but failed to understand each other because of a difference in title used for the same account. It may help some readers to give a few of the varying titles used.

The depreciation account (expense) is known as general amortization, amortization for depreciation, replacement, replacement insurance, plant depreciation, and accrued depreciation. Similarly, the depreciation reserve account is called reserve for amortization, insurance reserve for replacements, depreciation accrued, depreciation payable, and depreciation unpaid.

A casual inspection shows how easily confusion may result—a shining example being "accrued depreciation," which is used by one man as the "expense" account and by another as the "reserve" account!

The replacement fund account, the third account connected with depreciation accounting, is termed optional for the reason that up to the present time there has been no uniform custom as to keeping it at all. Many accountants prefer to dispense with it, leaving funds accumulated through depreciation to be merged with general assets. There is nothing wrong with this as long as the concern shows a substantial surplus above all liabilities and reserves. Few business concerns would regard with any patience a system that makes part of their liquid assets unavailable for current business purposes. At this day, however, public utilities must be regarded as a class unto themselves. Many state laws specifically require depreciation funds to be segregated and accounted for minutely, and that is also the general trend of commission practice. This is understood easily when we remember that these laws and commission regulations permit depreciation funds to be used for additions, extensions and improvements to the original plant, and in valuations it is frequently very essential to prove that replacements have not been charged to construction account. The suspicious attitude assumed by the federal government in income-tax returns is another strong incentive for keeping this account, since it may be incumbent upon the utility to show in court that an addition paid for out of replacement funds should not be taxed as income.

The title replacement fund for this account is submitted as being better and more descriptive than the usual depreciation reserve fund account, the latter being frequently confused with depreciation reserve account. It not only describes the purpose of the fund properly—i.e., to make replacements in the future—but for the time being it also "replaces" the loss due to depreciation of physical property with actual cash or other liquid assets. The entries establishing this fund as a matter of record, made concurrently with the expense entry in depreciation account as above, will be:

"Replacement fund account to Cash or Other investments: (Cash—or investments—set aside for future replacements; see entry for depreciation of this date.)"

When the bills for the cost of a replacement, as shown by previous entries in depreciation reserve account, are paid, the entry is:

"Accounts payable to Replacement account: (Cost of replacement of unit so-and-so paid; see entry dated ———.)"

It may happen that for good reasons the bills for this replacement have been paid out of general funds in due course of business when they fell due, but when "general cash" is reimbursed for the expenditure the obvious entry will be made with the same result.

If replacements were all that the fund could be used for (and it may be remarked that if the present attitude of the United States Treasury Department is maintained that may yet become the rigid rule), the debit balance of the replacement fund account would always be the same amount as the credit balance of the depreciation reserve account. But since general custom, state laws and commission practice sanction the use of these funds for additions and extensions, it is clear that the two balances will never agree. Certain definite information, however, will always be conveyed when considering plant account, depreciation reserve account and replacement fund account in combination. Thus:

Plant account less Depreciation reserve account equals present value of plant.

Plant account less Depreciation reserve account plus Replacement fund account equals total investment in plant.

The last being the value of the physical property as part of the total fair value in rate-making valuations, it is apparent how necessary to any utility is the proper and accurate keeping of the accounts connected with depreciation as outlined.

SPACE DISTRIBUTION OF FLUX DENSITY

A Practical Method of Predetermining the Variation of the Flux Over Armature Surfaces

BY ALFRED STILL

It is not an easy matter to predetermine the distribution of the flux in the air-gap of a dynamo or alternator, but none the less the manner in which the flux

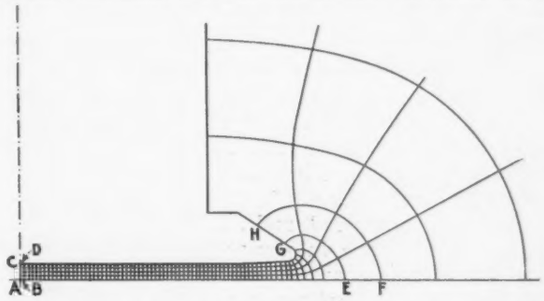


FIG. 1—FLUX LINES FROM ONE POLE OF DYNAMO

density will vary over the armature surface is frequently an important factor in design. An attempt will be made in this article to outline a practical method which the author has found to give very satisfactory results. Open-circuit conditions will alone be considered; but if these can be correctly predetermined, it is an easy matter to take into account the effect of the armature currents, and so obtain the flux distribution corresponding to any desired condition of loading.[1]

Although the effects of tooth saturation in slotted armatures may be of great importance, especially in continuous-current generators where the tooth densities sometimes attain very high values, these effects will not be considered here. The length of air-gap will be thought of as that of the *equivalent* gap, or, in other words, the actual toothed armature will be replaced by an imaginary smooth-core armature of the proper diameter to insure that the reluctance of the air-gap per unit area at any point on the periphery shall be the same as the average reluctance per unit area taken over the slot pitch.

In Figs. 1 and 2 an attempt has been made to represent the actual distribution of flux lines (1) for the condition of one pole acting alone without interference

[1] See "Air-Gap Flux Distribution in Dynamo-Electric Generators," by Alfred Still, in the *Journal of the Franklin Institute*, January, 1915.

from neighboring poles, and (2) for the practical condition of neighboring poles of equal strength and opposite polarity. The machine to which these diagrams apply is a continuous-current dynamo of pole pitch 37 cm, pole arc 27 cm, and equivalent air-gap of 0.8 cm at center of pole face. The air-gap is of uniform length except near the pole tips, where it is slightly increased, as indicated on the drawings. With a little practice, unlimited patience, and ample time in which to perform

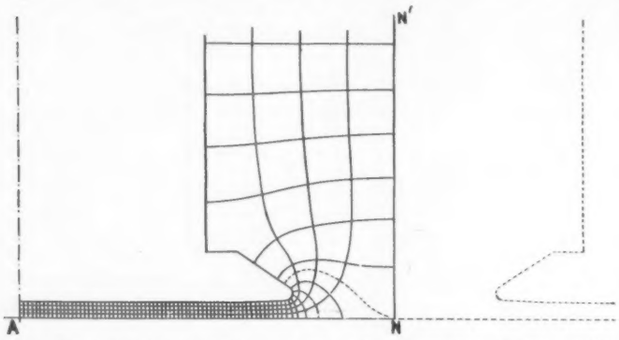


FIG. 2—ACTUAL AIR-GAP FLUX DISTRIBUTION (DYNAMO)

the work, diagrams of flux distribution such as those of Figs. 1 and 2 can be drawn, and they will indicate accurately the actual arrangement of the flux lines. The method is one of trial and gradual elimination of errors, based on the well-known principle that the flux lines will take such a distribution that the total permeance is a maximum, or, in other words, that the maximum flux will occur with a given mmf.

Lehmann's Method of Plotting Flux Distribution

Probably one of the most practical and at the same time most accurate methods of procedure is that proposed by Dr. Lehmann[2] and followed in preparing the flux diagrams (see Figs. 1, 2, 4 and 5). A section perpendicular to the shaft through the pole shoe and armature is considered, and all flux lines in the air-gap are supposed to lie in planes parallel to this section. Equipotential lines are drawn in directions which seem reasonable to the draftsman, and tubes of flux, *all having the same permeance*, are then drawn with their boundary lines perpendicular at all points to the equipotential lines. At the first trial it will generally be found that these conditions cannot be fulfilled, but by altering the direction of the tentative equipotential

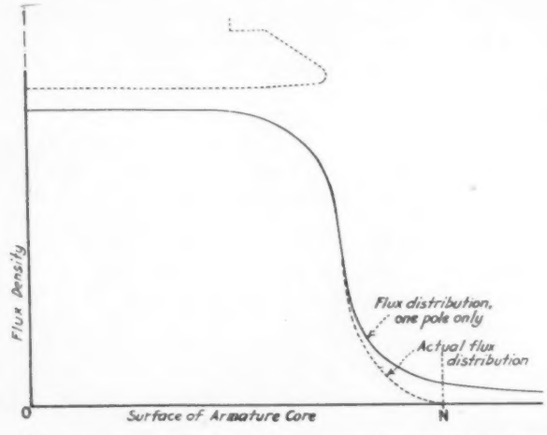


FIG. 3—FLUX DENSITY OVER ARMATURE SURFACE

lines the work is repeated until the correct arrangement of lines is obtained. The tube of induction *ABCD* (Fig. 1) is the first to be drawn. Its permeance is 0.25 because it consists of four portions in series, each one of which is exactly as wide as it is long (a thickness of 1 cm measured axially is assumed). Proceeding outward from left to right, and making each section of the individual tube of induction exactly as wide as it is long, the permeance of every one of the component areas in the diagram is always unity, and any complete tube, such as *EFGH*, has the same permeance (in this example 0.25) as every other tube. The computation of the total permeance between the pole shoe and armature over any given area is thus rendered exceedingly simple. Although the armature surface is represented as a straight line in all the figures illustrating this article, the actual curvature of the armature may be taken into account if preferred; but the error introduced by substituting the developed armature surface for the actual circle is generally negligible.

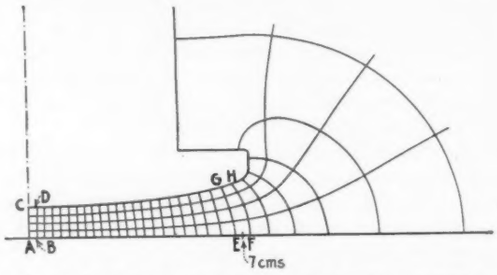


FIG. 4—FLUX LINES FROM ONE POLE OF ALTERNATOR

In Fig. 2 the flux lines have been drawn to ascertain the effect of the neighboring pole in altering the distribution over the armature surface in the interpolar space. The perpendicular *NN'* has been erected at the geometric neutral point, and may be considered as the surface of an iron plate forming a continuation of the armature surface *AN*. Thus *ANN'* will be an equipotential surface between which and the polar surface the intermediate equipotential surfaces must lie.

It may be mentioned that in Figs. 1 and 2, and also in the other flux-line diagrams, the pole core under the windings cannot properly be considered as being at the same magnetic potential as the pole shoe, relatively to the armature. The proper correction can easily be introduced in calculating the flux in each tube of induction; but since the present investigation is confined to the flux entering the armature from the pole shoe, it will not be necessary to make this correction.

The flux density at all points on the armature periphery is easily calculated when the flux lines have been drawn. Thus, since each tube of induction incloses the same number of magnetic lines, exactly the same amount

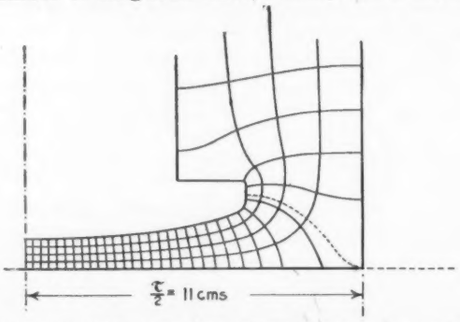


FIG. 5—ACTUAL AIR-GAP FLUX DISTRIBUTION (ALTERNATOR)

of flux will enter the armature in the space *EF* (Fig. 1) as in the space *AB*. If B_{ab} is the flux density in the tube *CDAB* at the center of the pole face, the average density over the space *EF* will be

[2] "Graphische Methode zur Bestimmung des Kraftlinienverlaufes in der Luft," *Elektrotechnische Zeitschrift*, Vol. 30 (1909), p. 995.

$$B_{ef} = B_{ab} \times \frac{AB}{EF}.$$

Thus curves of flux distribution such as Fig. 3 can readily be drawn. It will be seen that the dotted curve, giving actual distribution of flux for the case of Fig. 2, does not differ from the full line curve (case of Fig. 1, with no interference from neighboring poles) except in the interpolar space where the demagnetizing effect of the opposite polarity is appreciable. This causes the

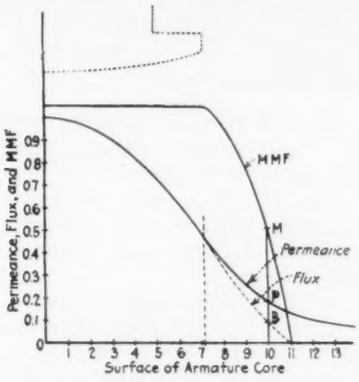


FIG. 6—METHOD OF OBTAINING MMF CURVE FROM FLUX CURVES

flux to diminish rapidly until it reaches zero value on the geometric neutral (the point N), where its direction reverses. This is what one would expect to find, because, although the magnetic action of any one pole considered alone will extend far beyond each pole tip, this action will not be appreciable beyond the interpolar space, on account of the shading effect of the neighboring poles. In order to ascertain how far the demagnetizing effect of neighboring poles is likely to extend when the air-gap is not constant but increases appreciably in length as the distance from the center of the pole increases, the case of a salient pole alternator has been considered. The flux lines and equipotential surfaces for an alternator with shaped poles are shown in Figs. 4 and 5. The object of shaping the poles by gradually increasing the air-gap from the center outward is, of course, to obtain over the pole pitch a distribution of flux which shall approximate to a sine curve. The data of the machine under consideration are as follows:

Pole pitch = 22 cm,

Pole arc = 14.3 cm,

Equivalent air-gap at center of pole face = 1 cm.

Air-gap at other points on armature surface $= \frac{1}{\cos \theta}$

where

θ is the angle (in electrical degrees) between center of the pole and the point considered.

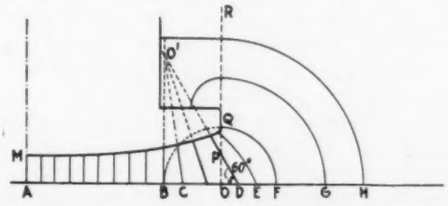


FIG. 7—APPROXIMATE FLUX LINES

In Fig. 6 the curve marked "permeance" has been plotted from Fig. 4. Its shape indicates the flux distribution over the armature surface on the assumption that the effect of neighboring poles is negligible. The mmf between pole shoe and armature core being the same at all points on the armature surface, it is evident that this curve of flux distribution will correctly represent the variations of air-gap permeance per unit area of the armature surface. Thus, the permeance per square centimeter at the point 7 cm from center of pole is the permeance of the tube *GHEF* in Fig. 4 divided by the area of the surface *EF*. The permeance of the tube *GHEF* is exactly the same as that of the tube *CDAB*, i.e., 0.25 per centimeter of depth measured axially. The area of the surface *EF* is 0.5, and the permeance per square centimeter at the point considered is therefore

$$P_7 = \frac{0.25}{0.50} = 0.5.$$

The dotted curve marked "flux" in Fig. 6 has been

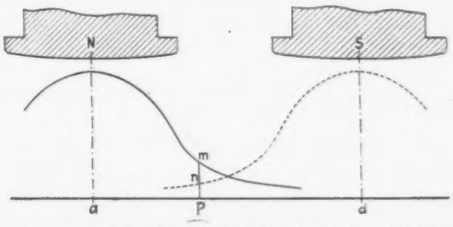


FIG. 8—EFFECT OF NEIGHBORING POLE IN MODIFYING FLUX DISTRIBUTION

plotted from Fig. 5, and shows the effect of the neighboring pole in reducing the air-gap flux and causing it to pass through zero value at a point exactly halfway between the poles. A comparison of the full line and dotted flux curves shows that, even with the greatly increased air-gap, the influence of the neighboring poles is not appreciable except in the uncovered spaces between the pole tips. The vertical dotted line in Fig. 6 shows the limit of the pole arc.

In order to find a scale for the flux curve it is necessary to know either the total flux entering the armature in the space of a pole pitch or the mmf between pole shoe and armature. If the resultant mmf tending to send flux from the pole to any point on the armature is known, the flux density can be calculated because, B = flux per square centimeter = (mmf) $\times$ permeance per sq. cm.

Thus, if the mmf necessary to overcome air-gap reluctance at center of the pole is known, the curve of resultant mmf at all points on the armature can be plotted. This has been done in Fig. 6, where the ordinate of the mmf curve at any point, such as 10, is simply $10 - M = \frac{10 - B}{10 - P}$, where the ordinate $10 - B$ of the flux curve must be expressed in gausses.

Short-Cut Method of Predetermining Flux Distribution

Although the method that has been described gives

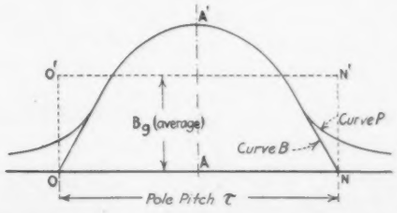


FIG. 9—APPROXIMATE CORRECTION FOR EFFECT OF POLES

excellent results in the hands of an experienced designer who can afford the time required to map out the actual paths of the flux lines, it is not suitable for general use in actual designing work. By adopting a

simple construction which assumes a certain flux distribution and avoids the drawing of equipotential lines, results of sufficient accuracy for practical purposes can very quickly be obtained. This construction is indicated in Fig. 7. A section through one-half of the pole shoe, showing the air-gap in its proper proportion, is drawn to a sufficiently large scale, preferably with the "developed" armature surface, because the construction is a little simpler if radial lines may be shown as perpendiculars erected on the horizontal datum line representing the armature surface. The distance *AM* is the "equivalent" air-gap, as calculated for the center of the pole face. Draw the perpendicular *OR* tangent to the pole tip, and, through the first point of tangency *Q*, draw the semicircle *BQF* with its center at *O*. Bisect *QO* at the point *P* and draw *PD* at an angle of 60 deg. with *AD*. Produce *DP* to *O'* where it meets the perpendicular erected on *AD* at the point *B*. Flux lines of which the length and direction will be approximately correct can now be drawn. All the lines from points on armature surface lying between *A* and *B* will be considered perpendicular to the armature surface, i.e., verticals erected on the datum line. Between the points *B* and *D* the lines will be considered straight, but with a slope determined by the position of the point *O'* through which they will pass if produced beyond the pole face. From the point *F* the equivalent flux line will be the arc of the circle described through the point *Q* with the radius *OQ*, and lines from points between *D* and *F* must be put in by the eye so that their curvature shall be something between the circle through *F* and the straight line through *D*. One of these intermediate lines has been drawn from the point *E*. Over the region beyond *F* all flux lines will be drawn as circles described from the center *O* and continued beyond the vertical *OR* until they meet the pole in a direction normal to the surface of the iron. Thus the line from the point *G* is completed by an arc of circle with its center at the junction of the line *OR* and the flat surface of the polar projection, while the flux line from *H* is continued as a straight line (the shortest distance) until it meets the pole perpendicularly to the surface.

Any desired number of lines can very quickly be drawn in this manner, and they may be thought of as the center lines of "equivalent" tubes of flux of uniform cross-section over their entire length. If, now, the length of any one of these imaginary flux lines be measured in centimeters, the reciprocal of this length will be the permeance per square centimeter between pole shoe and armature at the point considered. It is, therefore, an easy matter to plot a permeance curve similar to the one shown in Fig. 6. This curve, which represents the permeance per square centimeter of armature surface between pole and armature, can evidently be thought of as a flux-distribution curve on the assumption that one pole acts alone without interference from neighboring poles.

In regard to the actual flux distribution for no-load conditions, it may be argued that if two neighboring poles each acting alone would produce a flux distribution as shown respectively by the full line and dotted curves of Fig. 8, then the flux at any point *p* will be *pm* — *pn*. This method of plotting the resulting flux-distribution curve should give satisfactory results in the space between pole tips, but it does not provide for the gradual change in the flux distribution near the pole tips where the shading effect of the masses of iron becomes important. For the practical designer the writer recommends the approximation indicated in Fig. 9 where *P* is the permeance curve previously obtained. The flux curve is derived therefrom by drawing tangential straight lines through the neutral points (half way between centers of poles). In this manner the curve *OA'N* is obtained, representing the flux distribution on open circuit. This curve has yet to be calibrated, because the value of its ordinates cannot be determined unless either the mmf or the total flux per pole is known. In designing a machine, the total flux per pole will be known at this stage of the work, and the unknown factor will be the ampere turns on the poles necessary to produce this flux. Measure the area of the curve *OA'N* and construct the rectangle *OO'N'N* of exactly the same area. The height of this rectangle will be a measure of the average density over the pole pitch. This is known to be

$$B_g \text{ (average)} = \frac{\phi}{\tau \times L_g}$$

where ϕ = total flux per pole in the air-gap,
τ = pole pitch in centimeters,
L_g = gross length of armature in centimeters.

In this manner a scale is provided for the flux curve *OA'N*, which should preferably be replotted. The curve of resultant mmf can now be derived as explained in connection with Fig. 6.

Since the permeance curve as obtained by either of the methods here explained does not take into account the reluctance of the armature teeth, or indeed the reluctance of any part of the magnetic circuit other than the air-gap, the actual ampere turns necessary to produce the required flux will be greater than the amount indicated by the maximum ordinate of the mmf curve of Fig. 6. The fact that the reluctance of the teeth at different points under the pole face is dependent upon the flux distribution tends to complicate the problem; but since this matter has been dealt with elsewhere[2] by the present writer, it will not be discussed further in this article. The correction for tooth saturation is of importance in continuous-current machines; but it is usually unnecessary in alternator design because the higher frequencies prohibit the use of high flux densities in the teeth.

Advantages of the Outlined Method

The writer believes that the method outlined above will enable the designer to obtain, with a minimum of work, flux-distribution curves which should be of great value to him in predetermining the characteristics of dynamo-electric machines. It is true that fairly satisfactory results can be obtained without the aid of flux curves when the design departs but slightly from a type of which the performance is known. The chief advantage of a method of design which involves the plotting of flux distribution curves lies in the fact that new machines, departing radically from existing models, can be correctly designed without using test data or empirical formulas of limited application.

Flood-Lighting of Signs by Gas-Filled Lamps

A new and promising field is the flood-lighting of building surfaces and painted signs by the use of 500-watt tungsten stereopticon lamps and parabolic reflectors on neighboring roofs or any convenient location. Frequently signs painted on water tanks, billboards, chimneys or walls are out of reach of electrical service and are difficult or expensive to wire. Projector lighting solves the problem at distances of several hundred feet and at moderate cost. The load is steady, the hours of burning are long, the installation is simple, and the opportunity is one of much interest to central stations, several installations of note having been made along these lines at Hartford, Conn., and in New Jersey.

[2] *Journal of the Franklin Institute*, January, 1915.

DIGEST OF ELECTRICAL LITERATURE

Generators, Motors and Transformers

Constant-Voltage Generator.—A note on a recent British patent (No. 11,399, 1914) of Crompton & Company, Ltd., and N. Pensabene for a self-regulating direct-current generator in which the brushes are placed at an angle of 60 deg. or 70 deg. with the neutral position, and a number of equally spaced tappings on the armature winding are connected by non-inductive resistors, so that the combination of the alternating-current and direct-current reactions produces a compensating effect.—London *Elec. Eng'ing*, June 3, 1915.

Lamps and Lighting

Unit of Candle-Power in White Light.—CLIFFORD C. PATERSON AND B. P. DUDDING.—A paper read before the British Physical Society describing and discussing the methods used at the (British) National Physical Laboratory and the results obtained in the standardization of high-efficiency metallic-filament lamps in terms of the unit given by the 10-cp pentane lamp. Such a standardization entails the comparison of two sources whose radiation in the visible spectrum, though continuous, differs appreciably in hue. The method adopted has been to interpose between the pentane lamp and the high-efficiency sub-standards five additional sets of lamps, each varying from the next in efficiency (or operating temperature) by such an amount that the difference in the hue of their radiations constitutes a regular color graduation in approximately even steps from the pentane color up to that of the 1.5-watt-per-candle tungsten-filament standards. If, now, each such set of sub-standards is standardized against the set below it—that is to say, the set whose light is one stage redder than its own—it is possible to arrive at a value for the final set by a series of photometric comparisons, in each of which the color difference, although perceptible, is too small seriously to trouble an observer with normal sight. In this way only relative values are obtained. The authors then discuss the determination of the absolute value of the unit of candle-power and the redetermination of the constants of the pentane lamp. They finally discuss the constancy of the unit of candle-power held in electric sub-standards. A set of 1.5-watt-per-candle tungsten standards has to be used nearly every day of the week, and a fundamental as well as a working set of these lamps is, therefore, kept. The working set fell in candle-power about 0.5 per cent during the continuous use of the past two years. As the fundamental set will be used perhaps only two or three times a year, its constancy for very many years is assured.—London *Electrician*, May 21, 1915.

Generation, Transmission and Distribution

Energy Supply on the Rand.—BERNARD PRICE.—A long abstract from his presidential address to the South African Institute of Electrical Engineers on the general aspects of electrical energy supply to the mining industry in the Johannesburg district. The business is controlled by two companies—the Victoria Falls & Transvaal Power Company and the Rand Mines Power Supply Company—the latter company being a subsidiary of the former, and the combined system being operated and managed by the Victoria Falls & Transvaal Power Company. It comprises a small number of large consumers scattered over a compact area, which takes the form of a narrow strip about 45 miles long, stretching from east to west. There are three generating stations along this strip—Brakpan, Simmer Pan and Rosherville. There is also an outlying station on the Vaal River at Vereeniging, situated about 35 miles due south of Johannesburg, which feeds energy into the area at Robinson Central, a point about 5.5 miles west of Rosherville. Distribution is carried out at 20,000 volts overhead or underground over all sections of the area, excepting

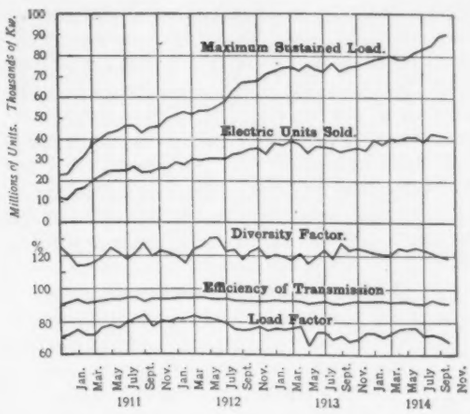


FIG. 1—ELECTRIC LOAD OF COMBINED SYSTEMS

that in the neighborhood of Simmer Pan and a small portion of that fed with energy from Brakpan, where the pressure is 10,000 volts. The main transmission system is at 40,000 volts, but the energy generated at Vereeniging is transmitted to Robinson Central at 80,000 volts. At Vereeniging the coal supply is near by and the water supply is not restricted. It has proved advantageous to expend capital upon transmission lines from an outlying station situated favorably as regards water supply and in close proximity to a colliery, and to send energy therefrom in the form of electricity rather than fuel. Under these conditions, the stations at Vereeniging and Brakpan, which are nearest to the source from which their fuel is drawn, are operated at the highest possible load-factor, and Simmer Pan and Rosherville are left to take the remainder of the load

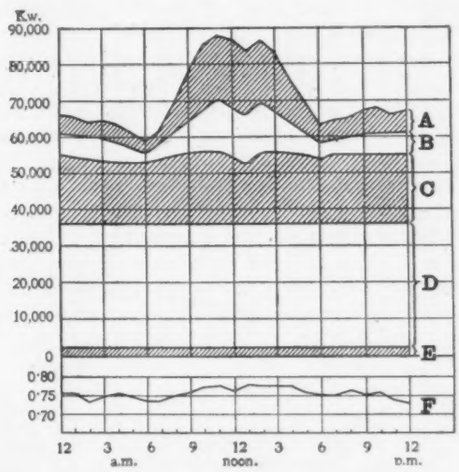


FIG. 2—COMPOSITE LOAD CURVES (APPROXIMATE) OF COMBINED SYSTEMS

at a lower load-factor. The total of kilowatt-hours consumed during the year 1914 was 519,600,000, of which 514,500,000, or 99 per cent, was for mining, 2,800,000, or 0.55 per cent, for other industrial purposes, and 2,300,000, or 0.45 per cent, for bulk supply to municipalities. The author then discusses load curves and the diversity-factor. The latter is defined as the ratio

between the aggregate of the individual maximum demands (which are non-simultaneous) and the maximum aggregate of simultaneous individual demands taken at the points of delivery in each case. In Fig. 1 statistics are given regarding the load-factor, diversity-factor and losses for the power companies' system in the form of monthly figures extending over the last four years. The diversity-factor varies between 1.2 and 1.25, which means that from 20 to 25 per cent more plant equipment would have been required to meet the demands if there had not been diversity between the hourly humps and hollows on the shape of the smoothed curves of the individual loads. This factor, being obtained from smoothed curves only, eliminates the very much greater amount of diversity which must exist between the short-line fluctuations on the charts obtained from curve-drawing wattmeters. Such short-time fluctuations of the individual loads are almost entirely due to the winders and haulages, and there are so many of these that very complete diversity takes place between them. Fig. 2 shows how the companies' load curve is built up. In this diagram *A* represents a load of 150 winders and winches (55,000 kw installed, continuous rating), *B* represents a load of twenty-seven compressors (17,500 kw installed), *C* miscellaneous load, underground and surface, *D* 4000 stamps and 200 tubes, and *E* industrial and municipal loads. *F* is the power-factor.—London *Electrician*, May 21, 1915.

Long-Distance Transmission.—George R. Dean.—In a continuation of his highly mathematical serial on the differential equations of long-distance transmission the author deals with the calculation of line losses and with the case of a line of finite length short-circuited on the receiver end.—London *Electrician*, June 4, 1915.

Installations, Systems and Appliances

Balance Systems of Protection.—C. C. Garrard.—Balance systems of protection of cables, generators and transformers are based on the principle that the voltages or currents in different parts of the circuit are balanced against each other under normal conditions, a fault causes an unbalancing, and this unbalancing is arranged to trip the circuit-breaker. The Merz-Price system for cable protection is a voltage balance and depends upon the balancing of emfs in the secondaries of current transformers situated at either end of the cable. The connections for a single cable are illustrated in Fig. 3. Two pilot wires are necessary. The secondaries of the two series transformers are reversed with regard to each other, so that with the current through the cable in either direction the secondaries buck against each other and no current is produced in the relay. Should, however, the currents at either end become unequal due to a leak somewhere in the feeder,

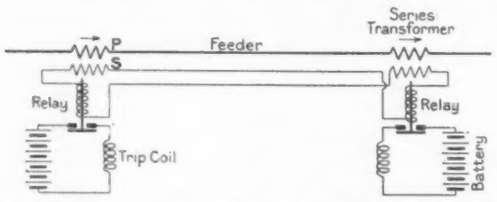


FIG. 3—FEEDER PROTECTION BY MERZ-PRICE BALANCED-VOLTAGE SYSTEM.

then the secondary voltages no longer balance, and a current will be produced in the relays, and, if large enough, trip the circuit-breakers at both ends. It is usual to set the relay so that a leakage current equal to 100 per cent of the normal full load of the cable causes the relays to operate. The author describes different relays made by various British manufacturers and special designs of series transformers for this purpose. He then takes up the Merz-Price protection system for generators and transformers, in which a system of current balancing and not voltage balancing is used.—London *Electrician*, May 21, 1915.

Wires, Wiring and Conduits

Effect of Insulating Resistance on Armored Cables.—A. Gavand.—If an armored cable forms part of a high-tension network, any fall in its insulation resistance

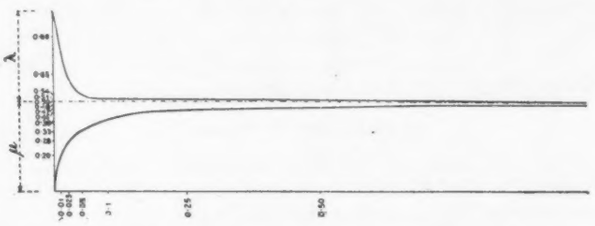


FIG. 4—VALUES OF λ AND μ AS FUNCTIONS OF ρ

may seriously affect the potential difference between the cable and the earth. The matter becomes of great importance in high-tension three-phase installations with an insulated neutral point. In tests carried out at the maker's works the insulation resistance of armored cables often amounts to several hundred megohm-miles. But when a cable has been laid and a number of joints have connected it with other cables figures of this order of magnitude are never obtained. It is not unusual to find an insulation resistance varying from 1 to 10 megohm-kilometers. But, even with these figures, the variation in the difference of potential between the cable and earth is very slight, though this would not be the case if the insulation resistance fell to 100,000 ohm-kilometers. The author investigates the law which connects the voltage difference between the armored cables and earth with the insulation resistance. He considers the case of two cables *A* and *B* between which there is a periodic voltage difference $U \sin wt$. He gives the formulas for the case where the insulation resistance of *A* is infinite, and of *B* is ρ. The voltage between *A* and earth P_a is $= \lambda U$, and the voltage between *B* and earth P_b *is* μU. Fig. 4 gives λ and μ as functions of the insulation resistance ρ in fraction of megohm.—London *Electrician*, May 21, 1915.

Electrophysics and Magnetism

Ionomagnetic Rotation.—A. Righi.—An account of his researches on what he calls "magnetic rays." He finds that a body turning lightly on an axis and placed inside a gas suitably diluted and ionized (for instance, by means of sparks) will commence to rotate around its axis as soon as a magnetic field is created in the direction of the axis. This phenomenon the author has called ionomagnetic rotation. He explains it as follows: It is known that the path of an electrically charged particle (ion or electron) changes when a magnetic field commences to act, and when this field is uniform the path becomes a helix with its axis parallel to the field. The sense in which this curve is followed is identical with the sense of the current flowing in the coil producing the field when there are negative ions or electrons; the sense is the opposite when there are positive ions. So when there exists a magnetic field the ions and the electrons will follow helical areas instead of straight paths. On the basis of this fact it has been possible to demonstrate by certain calculations, and also simply by geometrical considerations, that the shocks produced on the surface of a movable body by the ions of the same sign—for instance, the positive ones, under

the action of the magnetic field—will be directed all in the same sense and all around the body, thus producing the rotation of the latter. This will occur in the same sense as the current producing the field in the case of positive ions, and in the contrary sense in the case of negative ions. As the couple changes sign with change in sign of the electric particles, the ionomagnetic rotations will be generally produced by the difference of two couples of contrary signs. At the beginning of these researches the author was for long in doubt whether the rotations observed could be explained by the actions of the ordinary electromagnetic forces. Having finally succeeded in eliminating this doubt in his own mind, he has been led to an opposite conclusion —that is, to suppose that the well-known forces which provoke the movement of a conductor through which an electric current is passing, when other currents or a magnetic field are acting, are the result of the shocks of the electrons which, according to modern theories, move in the interior of the conductor and constitute the current.—Abstracted from *Atti Asso. Elet. Italiana* in London *Electrician*, June 4, 1915.

Ionization by Positive Rays.—NORMAN CAMPBELL.—An account of an experimental investigation on the liberation of electrons from the surface of a copper plate struck by the positive particles from heated phosphates. The author determined the relation between P, the number of electrons liberated by each positive particle, and V, the potential difference through which the particles have fallen. This relation is given in diagrams. It is suggested that the fall in P for the largest values of V may be due to the beginning of the stage at which the particles can penetrate the surface layer of the metal, exhibiting one of the properties which distinguish alpha rays from canal rays. At the highest potentials which could be studied no indication was obtained of the acquirement by the positive particles of the other distinctive property of alpha rays, the great ionizing power.—*Philos. Mag.*, June, 1915.

Electrochemistry and Batteries

Addition Agents in Electroplating.—A. MUTSCHELLER.—An account of an experimental investigation of the function which certain colloids have as addition agents in improving metallic deposits. The author's experiments led to the conclusion that the addition of these colloids causes absorption phenomena whereby the relative migration velocities of the anions and cations are changed. His experiments show that the best metallic deposits on the cathode are obtained when the migration velocity of the anion becomes zero and the migration velocity of the cation becomes unity. In this case the cations migrate to the cathode as fast as they deposit.—*Met. and Chem. Eng'ing*, June, 1915.

Units, Measurements and Instruments

Self-Induction of Solenoids of Appreciable Winding Depth.—C. BUTTERWORTH.—A brief abstract of a (British) Physical Society paper. The existing formulas for coils—namely, those of Rosa and Cohen—are shown to be inaccurate, the error amounting to one-fifth of 1 per cent for the best formula when the winding depth is one-tenth the diameter of the coil. For greater winding depths the error is larger. The inaccuracy in Rosa's formula is due to the neglect of curvature in correcting for thickness, while in Cohen's formula the error is due to the approximate method of development. New formulas are developed by methods which are free from such approximations and which apply to any coil for which the length is greater than twice the diameter and the winding depth is less than one-tenth the diameter. These formulas are capable of giving eight-figure accuracy. Simplified formulas are also given which are suitable when only four-figure accuracy is required. In the note from which this abstract is taken the formulas are not given.—London *Electrician*, May 14, 1915.

Measurement of Power-Factor.—R. D. GIFFORD.—The conclusion of his illustrated serial. The author gives the results of a test of a six-unit, three-phase unbalanced-circuit power-factor meter of the induction-dynamometer type. The results of the test substantiate the theory. The author finally deals with the four-unit power-factor meter on unbalanced three-phase circuits, the frequency error of induction-dynamometer instruments, power-factor meters with artificial scales, and the induction-dynamometer synchroscope.—London *Electrician*, April 30, 1915.

Telegraphy, Telephony and Signals

Future Progress of Cable Telegraphy.—H. W. MALCOLM.—The conclusion of his long mathematical serial. In summing up the author thinks that much may be expected from the present type of cable by an advance along the lines which are indicated by theory for the improved formation of the signals at the sending end and for their better detection at the receiving end. The principle of all these methods consists in the sacrifice of the magnitude of the signal for the purpose of obtaining improvement in its shape. The natural corollary, and the complement of this process, is the restoration of size by reduction of attenuation, a result which is only to be attained by loading. In contradiction to the generally accepted opinion, the increase in inductance which can be attained in practice is far from being ineffective in the telegraph cable. But in order that the full significance of loading may be brought out the signaling conditions must be rearranged. Hitherto signals have been formed exclusively by the extended "tail" of the arriving wave, the "head" being infinitesimal. By the use of loading, the steep head may be given sufficient height to actuate the receiver, and the tail may be reduced to a convenient size by adjustment of the signaling apparatus. It is not merely a question of improved speed, but rather of a fundamental change in the method of transmission—a change which will bring submarine telegraphy into line with telegraphy on land and render available all the systems of signaling which are employed on land. It follows, as a first step, that if the design of a new cable is to make any pretense to scientific exactitude it is essential that all the cable constants should be specified and measured, for on the attenuation constant and not on the "KR" of the cable will the speed of working —and, therefore, the value of the cable—increasingly depend. At least as great an advance may be hoped for as in telephony, where such an altogether disproportionate increase in efficiency has been attained without increase of cost that it is now inconceivable for a new cable of any importance to be laid without loading of some kind. It is probable that the loading of the first telegraph cable will be carried out on the continuous plan. But sooner or later the problem of coil loading must be faced. The loading of telegraph cables is of importance just now if cable telegraphy is to hold its own against competition of wireless telegraphy.—London *Electrician*, May 28, 1915.

Miscellaneous

British Institution.—The annual report of the Council of the British Institution of Electrical Engineers. On May 1, 1915, the total membership of the Institution was 6811, compared with 7045 on the same date in 1913.—London *Electrician*, May 28, 1915.

F. S. Pearson.—An "appreciation" of the life and work of Dr. F. S. Pearson from the pen of Mr. H. F. Parshall.—London *Electrician*, May 21, 1915.

Book Reviews

EXPERIENCES IN EFFICIENCY. By Benj. A. Franklin. New York: The Engineering Magazine Company. 168 pages. Price, $1.

Mr. Franklin's book will interest all those who desire to become students of the vast literature on the subject of the so-called efficiency methods in shop organization. Those who benefit by the perusal of books on this subject will find in Mr. Franklin's book a valuable work.

INSTALLING EFFICIENCY METHODS. By C. E. Knoeppel. New York: The Engineering Magazine. 258 pages, 103 illus. Price, $3.

The intelligent preface with which this work is introduced by its author commends the book, which is worthy of careful study and thought. The numerous examples, the careful manner in which they are described, the diagrams and the schedule cards are bound to repay the reader of this interesting volume, in spite of the rather large flood of publications of a similar nature.

FINANCING AN ENTERPRISE. A Manual of Information and Suggestion for Promoters, Investors and Business Men Generally. By Francis Cooper. New York: The Ronald Press. 524 pages. Price, $3.

Mr. Francis Cooper's book, which is passing through its fourth edition, seems to fill a gap in practical commercial literature. Such chapters as "Requisites of a Successful Enterprise," "Capital and Management," "Importance of Investigation," "Speculative Enterprises," "Experimental Work and Model-Making," "Patents," "Monopolies," "Capitalization," "Excessive Capitalization," "Presentation" and "Prospectuses" are all worthy of reading. The philosophical discussion on "Promoters" and "Financiers" is instructive as well as entertaining. The book deserves to be in the hands of all seeking the lessons to be drawn from others' experience.

ELECTRIC RAILWAY HANDBOOK. By Albert S. Richey, assisted by William C. Greenough. New York: McGraw-Hill Book Company, Inc. 832 pages, illus. Price, $4.

American electric-railway engineering practice is presented in concentrated form in this useful book, which should find a place in every office where such information is needed. Unlike the three well-known electrical engineers' handbooks which were written by numerous authors under supervising editors, this work is the product of two men who have assumed the responsibility of selecting what is useful from the immense mass of available literature. A very large proportion of the book is taken from committee reports of the American Electric Railway Engineering Association, but the publications of the American Institute of Electrical Engineers, the *Electric Railway Journal* and other engineering papers have been copiously quoted and with excellent judgment. The book is divided into eleven sections, the relative lengths of which are as follows: Roadbed and track, 12 per cent; buildings, 5 per cent; train movement, 11 per cent; railway motors, 13 per cent; controlling apparatus, 7 per cent; current-collecting devices, 2 per cent; trucks, 7 per cent; braking, 7 per cent; rolling stock, 8 per cent; transmission and distribution, 24 per cent; signals and communication, 4 per cent. Certain defects have resulted from the attempt of two men to cover such a wide field as electric-railway engineering. One of these is the neglect of much useful information which has not yet come to the attention of the A. I. E. E. and A. E. R. E. A. committees, but which is common knowledge with experts in particular fields; another is the insertion of a certain number of data which specialists would know to be obsolete. These criticisms should not be taken as reflecting seriously on the book, which is undoubtedly one of the most important in its field. One of the best chapters is that on electrolysis, which was evidently written by one who knows his subject so well that the quotations from other authorities seem superfluous. The authors have also shown a broad appreciation of the A. I. E. E. Standardization Rules, which are liberally quoted under appropriate headings instead of being reproduced in their entirety in one place. The most useful function that the book will serve will be to put the average engineer in possession of the important work of the leaders of their profession as embodied in committee reports, papers and discussions, the whole selected with the judgment of one who knows their value. The typography is good, and the numerous illustrations are reproduced on an unusually large scale for a handbook.

DISPLAY WINDOW LIGHTING AND THE CITY BEAUTIFUL. By F. Laurent Godinez. New York: The William T. Comstock Company. 226 pages, 115 illus. Price, $2.

In its twelve chapters this book covers the subjects of the city at night, advertising and attraction, utilization of light, cause and effect, lighting with gas, lighting with electricity, lighting of signs, color attraction, attraction in display lighting before and after, and modern display lighting. The book is well illustrated with 114 views relating to good and bad lighting and a frontispiece bearing a portrait of the author. In the preface the author states that "although there has been a society in existence since 1907 devoted to the engineering aspect of illumination, it has never advanced far enough along purely *utilitarian* lines to even define standards differentiating between useful and useless lighting equipment. . . . It is to be regretted that a society organized for the avowed purpose of bettering lighting conditions is but a publicity organ played upon by wrangling manufacturers—one with pipes hideously inharmonious, and, incidentally, an organ which has nearly played its last tune. . . . The author has mentioned with pleasure those manufacturers whose products have been largely responsible for the success of a specialist who holds himself *personally* responsible to every client for the durability, efficiency and satisfaction of every element included in his specifications." No other statements need be made to show the manner in which the author has handled his subject.

Books Received

Theorie der Elektrizitat. By Dr. M. Abraham. Leipzig, Germany: B. G. Teubner. 402 pages, 11 illus. Price, 11 marks.

Reportorium der Physik. By Rudolf H. Weber and Richard Gans. Leipsig, Germany: B. G. Teubner. 434 pages, 126 illus. Price, 8 marks.

Electrical Instruments in Theory and Practice. By W. H. F. Murdoch and U. A. Oschwald. New York: Macmillan Company. 366 pages, 164 illus. Price, $2.75.

Elektrochemie Wässeriger Lösungen. By Dr. Fritz Foerster. Leipzig, Germany: Johann Ambrosius Barth. 804 pages, 186 illus. Price, paper, 30 marks; cloth, 31.50 marks.

District Heating. A Brief Exposition of the Development of District Heating and Its Position Among Public Utilities. By S. Morgan Bushnell and Fred. B. Orr. New York: Heating and Ventilating Magazine Company. 290 pages, 82 illus. Price, $3.

POWER AND OPERATING SECTION

RECORDS OF SPEED VARIATION

Method Used by Dayton Power & Light Company to Show Line-Shaft Speed Changes

BY F. B. STEELE, POWER ENGINEER

The variation of speed in connection with most operations in a manufacturing plant is a source of loss that eventually is apparent in decreased output, increased maintenance, depreciation, and the grade of the product. Speed variation is thus a vital problem in plant operation with mechanical drives and one of the considerations that have helped to promote the electric motor and the sale of energy by a central station. An accurate knowledge of speed conditions in connection with different drives in different types of plants is, therefore, convincing information for use by the solicitor when discussing power problems with the management of industrial plants. The average man is not aware of the extent or nature of speed variation in his plant for the reason that he has no means of accurately finding this out and carefully studying his conditions.

The accompanying records have been made by the writer and show speed variations on line shafts driven by various types of prime movers. Since these records show continuous performance and the period of speed variation as well as the amount, they are valuable in studying and promoting plant efficiency in addition to their value in the hands of a motor-service salesman.

Fig. 1 shows the speed variation on a main-line shaft in a planing mill driven by a single-cylinder four-stroke-cycle gas engine. Fig. 2 shows variation of speed on a main-line shaft in a flour mill with constant load driven by a 200-hp directly connected automatic slide valve steam engine. Fig. 3 is a record for a line shaft in a flour mill driven by an 80-hp two-cylinder gas engine. Fig. 4 is a record from the same shaft as in Fig. 3 at the instant the load is thrown off. Fig. 5 shows the speed variation on a 135-ft. line shaft driven by a 15-hp motor. This motor drives forty-one machine tools operated by thirty-six machine men. The load is very intermittent. Fig. 6 shows the speed regulation of a 60-ft. line shaft driven by a 50-hp induction motor and

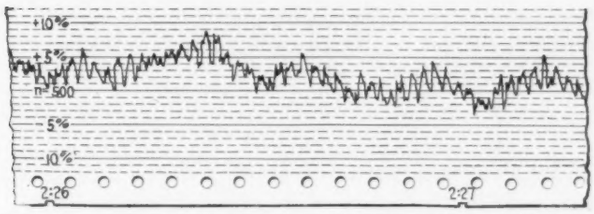


FIG. 1—SPEED VARIATION OF PLANING-MILL MAIN-LINE SHAFT DRIVEN BY SINGLE-CYLINDER GAS ENGINE

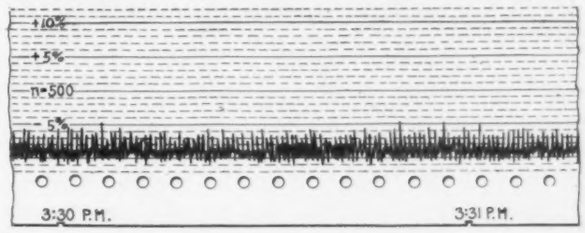


FIG. 2—SPEED VARIATION ON FLOUR-MILL MAIN LINE SHAFT DRIVEN BY DIRECTLY CONNECTED STEAM ENGINE

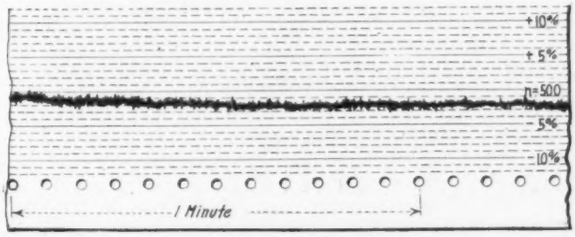


FIG. 3—SPEED VARIATION ON LINE SHAFT IN FLOUR MILL DRIVEN BY TWO-CYLINDER GAS ENGINE

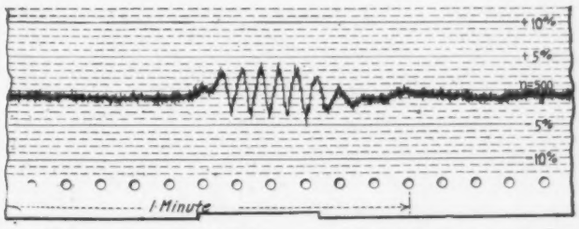


FIG. 4—SPEED VARIATION ON SAME SHAFT AS FIG. 3 AT INSTANT LOAD IS THROWN OFF

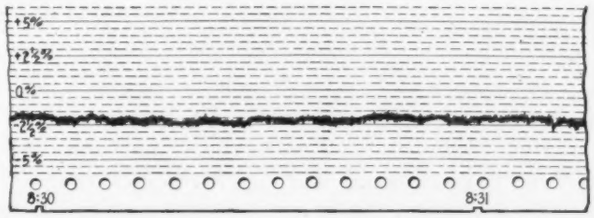


FIG. 5—SPEED VARIATION ON A 135-FT. LINE SHAFT DRIVEN BY AN INDUCTION MOTOR

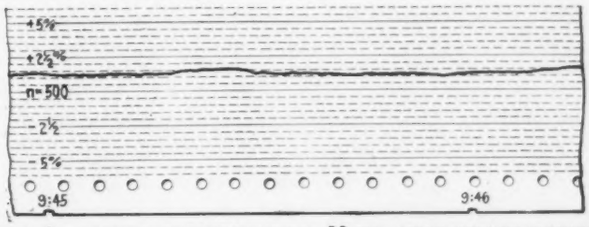


FIG. 6—SPEED VARIATION ON A 60-FT. LINE SHAFT DRIVEN BY AN INDUCTION MOTOR

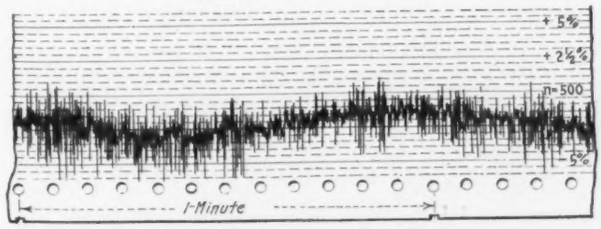


FIG. 7—SPEED VARIATION ON CORDAGE-MILL MAIN-LINE SHAFT DRIVEN BY A CORLISS ENGINE

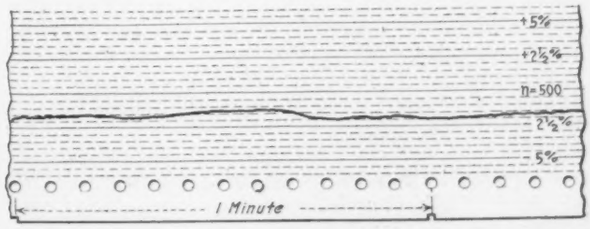


FIG. 8—SPEED VARIATION ON SECTIONS OF CORDAGE-MILL LINE SHAFT, EACH DRIVEN BY INDUCTION MOTOR

attached to the constant-speed end of a paper machine. Fig. 7 is a speed record taken on a main-line shaft in a cordage mill driven by a 22-in. by 42-in. Corliss engine and operating the spinning and spreader departments. Fig. 8 shows a line shaft serving the same demands as the one in Fig. 7 but divided into sections each driven by a 35-hp induction motor.

These records are made by use of the machine shown

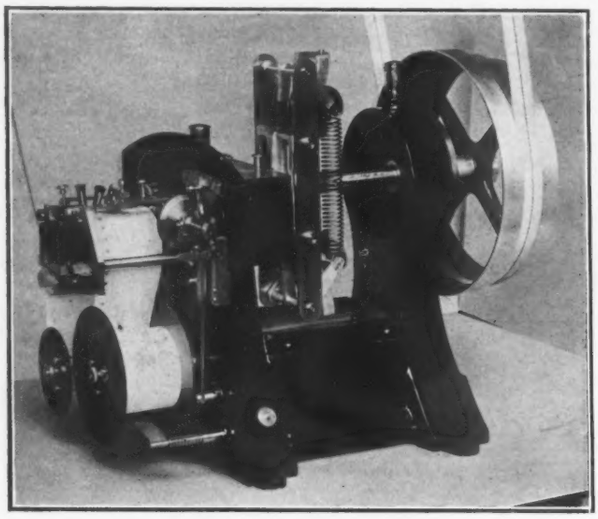


FIG. 9—TACHOGRAPH, WITH COVERS REMOVED, SHOWING RECORD TAPE AND MECHANISM

in Fig. 9, known as a tachograph and designed to demonstrate speed variations of a steam engine, line shaft, generator, motor or any other means of drive. This machine consists of a cast-iron frame supporting a short shaft to which a spring and ball governor is securely fastened. A steel rod in the center of the shaft is connected at one end to the balls of this governor through a series of levers. The other end carries with it a steel pen which moves back and forth as the centrifugal force on the balls of the governor is increased or decreased by the changes of speed. The pen rests upon a record tape which is properly calibrated in percentage variation of speed from the normal and is caused to move at right angles to the movement of the pen by a steel belt connected to the instrument shaft. The center line of the record is recognized as the normal speed of any apparatus tested and is obtained by driving the line shaft of the instrument at 500 r.p.m. A step pulley is fastened to one end of the instrument shaft and is belted to the apparatus to be tested with a ¾-in. canvas belt.

The exact pulley ratio cannot be secured on every installation, as shown in the accompanying charts, so that it is necessary at times to re-establish the normal or neutral line. When the machine is properly connected up, any variation in speed of the line shaft which will vary the speed of the instrument shaft above or below normal speed will be indicated in percentage directly on the chart, which is calibrated in plus percentage for a speed above normal and minus percentage for a speed below normal. Three sets of springs are furnished with the instrument, giving a percentage variation on the chart of 6, 12 and 24 per cent. When the speed of a line shaft varies from 150 r.p.m. normal to 142 r.p.m. minimum, 6 per cent springs would be used. If the speed should drop to 138 r.p.m., the pen would tend to go off the chart and the 12 per cent springs would be required. The machine is extremely sensitive, and the value of the records taken by it depends upon the care with which it is handled.

Operating and Test Data for a Fuel-Oil Engine and Generator

BY R. B. WHITE

The following information and data cover a test of a fuel-oil engine that operates in parallel with a high-speed steam engine in the plant of the Goodland (Kan.) Light & Power Company as mentioned in the Power and Operating Section of the ELECTRICAL WORLD for June 12.

The oil engine is of the 60-hp two-stroke-cycle semi-Diesel Munic crude or fuel-oil design belted from the flywheel to a 75-kw, three-phase, 2300-volt, sixty-cycle Fort Wayne generator operating single-phase at 2200 volts. This unit operates in parallel with a 100-kw, single-phase generator driven by a 165-hp single-cylinder Chuse steam engine. The steam is generated from coal costing $3.25 per ton delivered. The oil engine uses Kansas fuel oil, which costs 2.3 cents per gallon and is of about 24 deg. Baumé grade.

Before installing the oil engine the coal bill was $600 per month, whereas the present coal and oil bill does not exceed $300 per month. When firing the boilers with fuel oil, it took 500 gal. per day. To get definite figures the writer conducted a test on this plant during which time the fuel data shown in the table below was secured.

FUEL DATA, GOODLAND LIGHT & POWER COMPANY

Hour	Volts	Amperes, Average	Oil Used, Gallons	Watt-hour-Meter Reading in Kw-hr.
9 to 10 P.M.	2200	14.5	6.8	28
10 to 11 P.M.	2200	11.0	4.5	20
11 to 12 midnight	2200	9.5	4.0	15
12 midnight to 1 A.M.	2200	9.5	4.0	14
1 A.M. to 2 A.M.	2200	8.7	4.5	12
Totals			23.3	89

At another time it was also noted that for seven hours (5 p. m. to 12 midnight) through the peak load, 45 gal. of fuel oil, worth 2.3 cents per gallon, was used. This was an average of 6.5 gal. per hour, or 52 pints, at a cost of 14.9 cents per hour, which for the day run of fourteen hours would be $2.09 per day, or $62.70 per

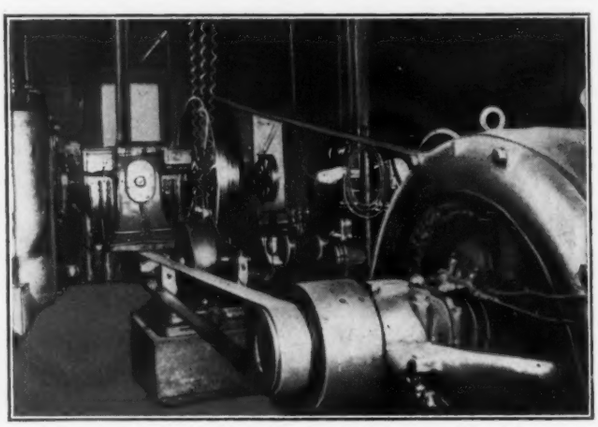


FIG. 1—OIL-ENGINE-DRIVEN UNIT AND STEAM-ENGINE-DRIVEN UNIT IN PARALLEL

month, for fuel oil. During the seven hours' test above mentioned the voltmeter showed 2200 volts and the ammeter, which was read three times per hour, showed the following average readings: 15, 17, 16, 17, 14, 11 and 9½ amp respectively.

These data show that it took 23.3 gal. of fuel oil worth 2.3 cents per gal. for a watt-hour-meter registration

of 89 kw-hr., showing a fuel cost of 0.602 cent per kw-hr. at light loads. Full-load operation would be less at this plant, since oil engines work best at near full loads.

Goodland (Kan.) is about 4500 ft. above sea level. Allowing a 3 per cent loss of power for each 1000-ft. elevation, the loss of power for the engine due to altitude would be 13.5 per cent. The following are the assumed efficiency reductions between the engine and switchboard:

	Per Cent
Loss due to altitude	13.5
Loss due to belt transmission	8
Loss due to efficiency of generator	12
Total	33.5

From these data it was decided that an ammeter reading of 16.5 amp represented a load of about 60 hp at the engine pulley, and consequently a proper load, although the operator claimed that a load of 19 amp had been carried.

This installation is shown in Fig. 1. The details of the fuel-oil engine are better illustrated in Fig. 2. The charge is ignited by a compression of 150 lb. assisted by the hot ball head. No carburetor or valve gear is

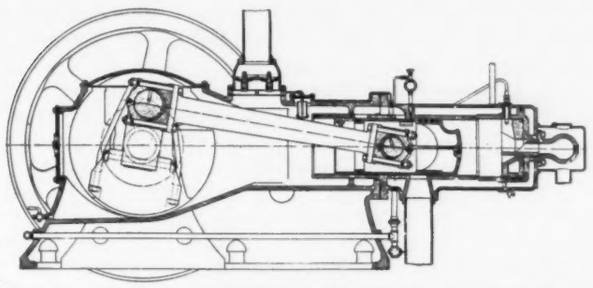


FIG. 2—SECTION SHOWING CONSTRUCTION DETAILS OF MUNIC FUEL-OIL ENGINE

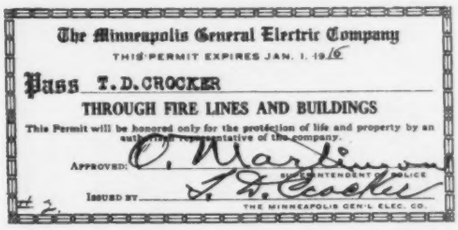
required. The engine takes air into the combustion chamber on the regular two-stroke-cycle principle from the crank case through ports. After the air is compressed the fuel is injected into the combustion chamber and onto red-hot parts which will vaporize and ignite a heavy fuel oil, which may or may not be refined and may be as heavy as 14 deg. Baumé. The speed variation guarantee of the maker is not over 2 per cent. The practical operation is satisfactory, for when a motor-driven deep-well single-acting pump furnishing the city with water supply is being operated at thirty-two strokes per minute, the voltmeter shows a variation of not more than 2.5 volts. When the pump is not being operated the variation is not more than 0.5 volt. The oil-engine generator and the steam-engine generator synchronize without difficulty and operate together without trouble.

Analysis of Boiler Defects

From a summary of conditions found in the steam boilers inspected by the Hartford Steam Boiler Inspection & Insurance Company, and reported in an annual tabulation, it appears that the greater portion of serious or dangerous defects are due to impure feed water. This is shown by the percentages of defects caused by scale, sediment and corrosion, as follows: Defective tubes or flues, 30 per cent; defective blow-offs, 8.6 per cent; sediment and loose scale, 8.4 per cent; adhering scale, 7.5 per cent; leakage around tubes, 6.7 per cent; external corrosion, 4.1 per cent; defective setting, 4.1 per cent; defective water gages, 4 per cent; defective pressure gages, 3.8 per cent; internal corrosion, 3.7 per cent; leakage at seams, 2.5 per cent.

Passes for Fire Lines Granted Central-Station Men

Officers, department heads and certain of the troublemen of the Minneapolis (Minn.) General Electric Company are provided with annual passes to enable them to cross police fire lines and enter burning structures. In all the company issues about twenty-five of these passes, and although many of them are never used, the men to whom they are issued carry them at all times so that,

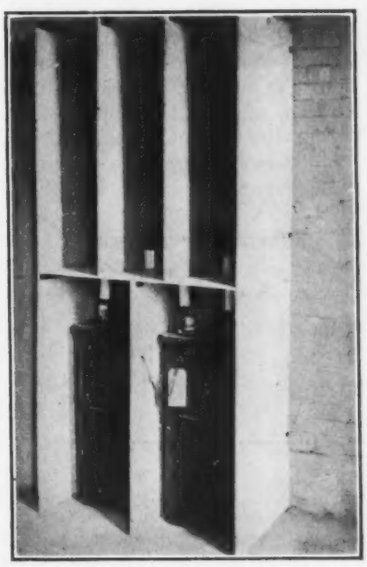

The Minneapolis General Electric Company
THIS PERMIT EXPIRES JAN. 1, 1916
Pass T. D. CROCKER
THROUGH FIRE LINES AND BUILDINGS
This Permit will be honored only for the protection of life and property by an authorized representative of the company.
APPROVED:
SUPERINTENDENT OF POLICE
ISSUED BY
THE MINNEAPOLIS GEN'L ELEC. CO.

CARD TO PASS ELECTRIC COMPANY'S MEN THROUGH FIRE LINES

should the occasion arise, they can go promptly to the protection of the company's property. The cards are signed by the superintendent of the Minneapolis police and by the assistant general manager of the Minneapolis General Electric Company.

Barrier Construction of Asbestos Board

Asbestos board 0.375 in. thick has been used advantageously in the construction of lighting transformer cells at the Eel Weir generating station of the Presumpscott Electric Company, which supplies energy to the paper mills of the S. D. Warren Company of Westbrook, Maine. As illustrated herewith, these cells are easily constructed by the use of angle-irons, brackets, nuts and bolts. In the case mentioned two station transformers occupy cells 16 in. wide, with three fuse

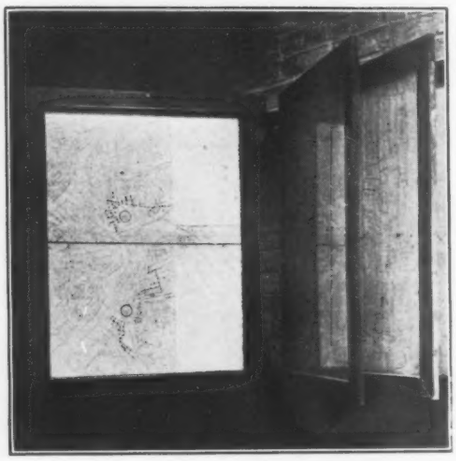


INEXPENSIVE HOME-MADE TRANSFORMER CELLS

compartments 11 in. wide mounted above. All cells are deep enough to protect the station operator from accidental contact. Bushings carry the leads from the upper to the lower tier, and no difficulty is found in insulating for 11,000 volts. The lower edge of each partition near the front is attached to the floor by small angles, to provide sufficient rigidity.

Saving Time for Troublemen

At the generating station of the Lowell (Mass.) Electric Light Corporation the quarters used by troublemen are provided with convenient maps of the distribution system, a set of which is shown in the accompanying halftone. These maps are mounted under glass in folding frames about 22 in. by 28 in. in size,



CONVENIENT MOUNTING FOR DISTRIBUTION MAPS

the frames being mounted on brackets fastened to the corridor wall by 2-in. by 0.375-in. angles. Sixteen sheets are thus set under eight double glass holders arranged so that the sheets and holders fold neatly back against the wall when not in use. A skylight provides ample light for consulting the maps during the day, and tungsten lamps mounted on the ceiling afford good illumination by night.

The Importance of Watt-Hour-Meter Maintenance

The importance of systematic testing and maintenance of meters cannot be too highly emphasized. "There is probably no other piece of apparatus that is called upon to operate efficiently under more varying conditions than the electric watt-hour meter," said Mr. W. L. Wadsworth, of the Minneapolis General Electric Company, before the recent convention of the Minnesota Electrical Association. It is subjected to all degrees of temperature, it may be installed in surroundings extremely clean or deplorably dirty, and to show to what extent uncared-for meters will become inaccu-

DATA TAKEN FROM WATT-HOUR METER TESTS

	In Test of 182 Meters, per Cent	In Competitive Test of Meter Types, per Cent	
		Old	New
Stopped or not recording	0.5	1.6	1.2
Recording below 70 per cent of load	7.7	1.1	0.61
Recording between 70 and 80 per cent of load	12.2	0.26	0.01
Recording between 80 and 90 per cent of load	11.0	2.2	0.50
Recording between 90 and 97 per cent of load	19.5	6.9	2.0
Recording between 97 and 102.5 per cent of load	38.0	85.2	93.4
Recording between 102.5 and 109 per cent of load	3.8	1.7	1.4
Recording between 109 and 114 per cent of load	1.6	0.35	0.31
Recording between 114 and 119 per cent of load	2.7	1.7	0.01
Recording 120 per cent of load or more	1.1	0.27	0.001
Creeping	0.5	2.3	2.0
Otherwise defective	0.5	2.9	0.44

rate, continued the speaker, the data in the first column of the accompanying table, from a test of 182 meters owned by a small Minnesota company, are of interest. The data in columns two and three of the table plainly show the advisability of removing as rapidly as possible any old-style meters with heavy moving elements not in first-class condition. The figures given by Mr. Wadsworth represent the observed comparative accuracy of two sets of commutator-type meters with diamond jewels. Those designated as "old," however, were equipped with copper disks, while those called "new" were the latest type.

Ways to Save Waste of Materials—and Expense

Some of the ways in which thrifty plant operators can reduce station and company expenses have been pointed out by Mr. H. F. Frasse, purchasing agent for the Brooklyn Edison Company, who has recently offered prizes of $25, $15 and $5 to lighting-company employees who submit the best papers on company thrift.

For example, cotton waste may be used over and over again, according to Mr. Frasse, by simply extracting the oil either by centrifugal action or by a cheap press. This reclaimed oil will, moreover, go toward reducing the lubrication account.

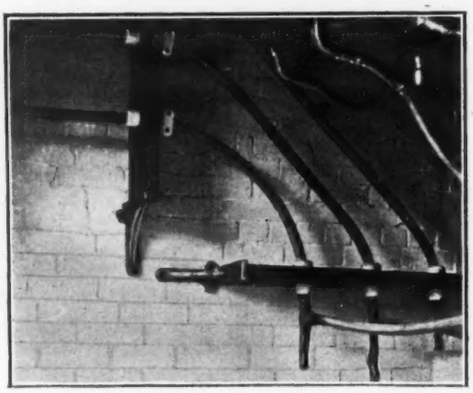
Used machinists' files, instead of being thrown away or sold as old metal, may be restored by a simple acid bath or may be recut by the same sand blast which many companies employ for removing old paint from iron structures.

Transformer oil which has become unfit for use might be bottled after pouring through some straining fabric, and would find ready sale to hardware, dry-goods or sewing-machine stores as an inexpensive lubricant.

Much money is lost by selling metal material to scrap dealers and metal brokers, who in turn find customers at a profit to themselves. If company accumulations could, on the other hand, be sold directly to the iron or brass foundries, the profit would more than pay for the care exercised. Meters, motors, cable, weather-proof wire and even second-hand generating machinery might be included.

Home-Made Cable Rack

In a power-station basement where appearance is not considered of great importance the home-made cable rack shown here is used. It consists of sets of 1.5-in. by 8-in. grooved brackets supporting pieces of slate 10



AN IDEA FOR AN EMERGENCY CABLE RACK

in. wide, 0.75 in. thick and recessed at the top, with holes bored at equal intervals in which 1.25-in. porcelain bushings are used in running the leads. The brackets were bolted to the brick wall and provide a rigid support for the conductors. In a new installation it is probable that conduit and three-conductor cable could be employed without an increase in cost.

COMMERCIAL SECTION

A Priceless Service

FEW people appreciate the vast amount of labor represented by such committee reports as were presented before the late N. E. L. A. convention. Almost a year ago the work of systematically combing the industry to ascertain the practice and the preference of every member company began, and it continued until convention time. Committees have been composed of many men selected for their specialized knowledge of the subject, so that in point of fact the report presented is the product of the united industry. Questions have been sent broadcast over the country, and the response has brought a wealth of information and opinion, pro and con, from which have been made deductions that are beyond dispute. Endless hours of arduous labor have been spent in the preparation of the reports. For this priceless gift of service every central-station man should be truly grateful.

The Commercial Evolution

GRADUALLY, year after year, through the cumulation of experience and the growth of knowledge in the work, the evolution of the central-station commercial man takes place. Not so long ago he was an electrical man who specialized in the work of selling; to-day he is fast approaching the mental attitude of the merchant, the manufacturer, the business man. He schools himself in the technical factors of his complicated business that his business foresight and his capacity may be the greater. But the problem has come to be commercial first and central-station afterward. How far this transition has progressed was a conspicuous point of interest in the Commercial Section papers presented before the N. E. L. A. convention in San Francisco. The report of the committee on merchandising and recent developments in electrical appliances strikes the keynote. It is a thorough presentation of the art of central-station merchandising. It is practically a textbook that embodies the scope of the broad market problems of creation and supply. It gives to every new worker in the field a clearer insight into both the theory and the practice than has ever been possible before. The report on the wiring of existing buildings and the report on electric-vehicle experience are no less comprehensive. They make available the years of experiment, the variety of first-hand knowledge, and the independent thought that have been contributed from every point of activity, analyzed and applied for use by every one. By means of such reports the marketing of electric service is being developed into a definite science which must add immeasurably to the appeal this field of opportunity makes to the young man.

Consumers' Satisfaction Versus Unit Profit

IN selecting the stock they intend selling many dealers choose that which will give them the largest profit per sale regardless of the ultimate satisfaction it may give the purchaser. To dealers with transient trade this may appeal as the only way of conducting a profitable merchandising business, but by those who look into the future and consider how it will affect electrical merchandising in general, the method will be looked upon as an obsolete way of doing business. A purchaser will not continue to patronize a dealer who has sold him a device which became inoperative or developed some defect shortly after it was first used. Furthermore, he will instinctively think that he cannot depend on any electrical devices and will purposely, or maybe unknowingly, warn his friends against using electrical apparatus. A much better basis for selecting stock is to choose those devices which are properly designed and constructed for the purpose they are to serve. If the choice lies between products of similar quality, then, and only then, may the one affording the most profit be chosen. But still better would it be to give the retail purchaser the benefit of the lower wholesale price, as in the long run more units would be sold and consequently the total profits would be larger. In any event, if a dealer can stand back of every appliance he sells the confidence of his customers will be secured, and they will unknowingly become his agents or new-business getters by interesting their friends in the use of electrical appliances.

Instilling the Merchant Spirit

"THE greatest need of the manufacturer to-day is the merchant spirit and method in distributing his products," declared Mr. John C. Bridgman in his address before a recent joint meeting of electrical jobbers and manufacturers at Chicago. "Most manufacturers," continued Mr. Bridgman, "apply the principles of scientific management to their factories, but they fail woefully in selling as good merchants should." This comment, delivered in friendly conference, is a criticism which applies even more pointedly to conditions in those other branches of the electrical industry where sales work has been imposed on men who are more experienced as technicians and operators than in their new-found commercial responsibilities. Influenced by fear of competitive prices, by the representations of purchasers, and by all the unknown factors of business, the electrical man too often falls into the path of least resistance and sells at the figure he can get for his wares, rather than at a price which represents intrinsic value, to which he has added a reasonable profit. Intrinsic value,

it must be remembered, will always command due recognition. Only the experience of the user is needed to place final confirmation on the intrinsic value which the manufacturer has put into his product. Electrical manufacturers, jobbers, dealers and contractors need to acquire confidence in their goods, and, as Mr. Bridgman suggests, in the principle of stabilizing prices as adopted by the true merchant who insists on doing business on terms that will insure him a fair return on his investment.

Perfecting Appliances Mechanically

Electric appliances have undergone a marked improvement mechanically within the last few years, a fact that is operating strongly for their greater popularity. Hardly any single factor has contributed so much to the practical utility of the electric flatiron, for example, as the attention now given by designers to cord protection. The steel spring that takes away the shock of rough usage at the point where the cord enters the iron has strengthened a part of the appliance that used to be particularly vulnerable in the hands of servants and others who failed to consider that the iron is entitled to reasonable care. Now we are coming to a closer study of the iron from the thermodynamic side, and the value of, say, an extra pound of material in the body—of minimum spacing between the heating element and the metal—is found to be a real talking point. Rapid conduction from the resistor to the body is a feature of importance. Safeguarding appliances against abuse is to-day receiving more attention than ever. From the fact that a 350-watt electric immersion heater can be kept in circuit to-day until it becomes cherry red in the open air and then dipped into a tumbler of cold water without injury we can see how far designers have gone in the direction of mechanical improvement. There is probably no more interesting field for combined scientific and "practical" development in the electrical industry than this mechanical perfection of small appliances in domestic and industrial service.

Electrical Table Decorations

Unusual opportunities for development of business await the electrical table decorator allied with the central station or with the contractor, if recent accomplishments in this field are gaged at their true significance. The range of possibilities fits every size of purse; the equipment can be used in various combinations over and over again, and the additional cost may be made almost nominal, if desired, in proportion to the total expense of a banquet. Long ago the specially designed transparency and the ordinary exposed-lamp type of sign won their way into banquet-hall favor, but lately discriminating organizations have begun to realize the remarkable artistic possibilities of combination floral and luminous displays to meet individual conditions. Concealed installations of lamps are opening new doors into the field of decorative table lighting, and the exquisite fixtures now available in the art-glass and ceramic industries place in the hands of the decorator appliances which only a half decade ago would have been almost unthinkable. No matter how simple or how complex the desired effect may be, electrical equipment is now available to produce it, and at a distributed cost per plate which robs the outlay of its burdens in certainly nine cases out of ten.

The Value and the Price

Committees appointed by the N. E. L. A. Commercial Section have prepared and presented to the commercial men of the industry an assortment of reports and papers containing material of much practical value. What will happen next? The actual good that will come of all this work must depend upon the extent to which it is utilized by the individual salesmen and sales managers. There is no motor-service salesman who can study the paper "Demonstration of a Power Sale" without finding some new thought to help him; no appliance salesman can fail to benefit by reading the merchandising report, and no manager can afford to lose the suggestion and advice that he will find on every phase of his activity. If any man could travel personally and visit every city where a lesson could be learned, it is doubtful if he would bring back with him half of what is offered in the convention papers.

Lighting Machinery Exhibits

The illumination of exhibits that display operating machinery of various kinds is a branch of window lighting which can be improved materially. The universal practice of builders and dealers is to paint machine frames black, deep green, or some other light-absorbing color, and compared with the total number of machine exhibits in store windows only once in a great while are the advantages of white enamel paint utilized. Here is a field for the use of small lamps even of the sign type, but with the proviso that easily adjusted reflectors shall be employed to keep glare out of the eyes of persons on the street. There is room, too, for the development of simple attachment fixtures, so that any specially interesting part of a machine can be thrown into relief by a well-directed bit of flood-lighting on a small scale. In fact, the opportunities for ingenious design in this direction are almost unlimited. By making use of contrasts, concentrating a small but shielded luminous flux upon the center of operating interest in the machine, the good points can be brought out more effectively, saving time for the passer-by—to say nothing about creating a superior attractiveness of display as an eye magnet. Many a busy pedestrian who now hurries past a window presenting machinery of wonderful ingenuity in full operation would stop to study the equipment if his attention were only focused on its cutting point, its delivery outlet, or its stock-tooling portions. The extra cost of bringing these important functions into emphasis by 5-watt lamps or 10-watt units would be small compared to the benefits.

Stage Craft in the Electric Shop

The Spring and Fall Festivals of the Kansas City Electric Light Company, and Why They Succeed So Well

BY MARIE J. RUSSELL, ELECTRIC SHOP MANAGER

THERE is nothing more important to the success of an electric shop than the element of "atmosphere" that pervades the shop itself. As a result of the "functions" which have been given in our Electric Shop in Kansas City, we are convinced that no reasonable expenditure for a proper background for the staging of all popular events in the salesroom should be denied, for the effect on the public makes all the difference between profit and failure.

The Spring Festival

The first electric show in Kansas City was held in our Electric Shop last year during ten days of the spring. The appliance business was naturally on the wane after the holidays, and in all probability would have continued so until the fan season, but we decided to infuse a bit of stimulant into the spring market through the institution of a "Spring Opening—Electric." It was an electric show, not unlike other electric shows, but to give it a character and appeal that would raise it above the commercial level and establish it as a social event no less, we transformed our Electric Shop into a Japanese tea garden, carrying out the idea in every detail of our decoration and advertising.

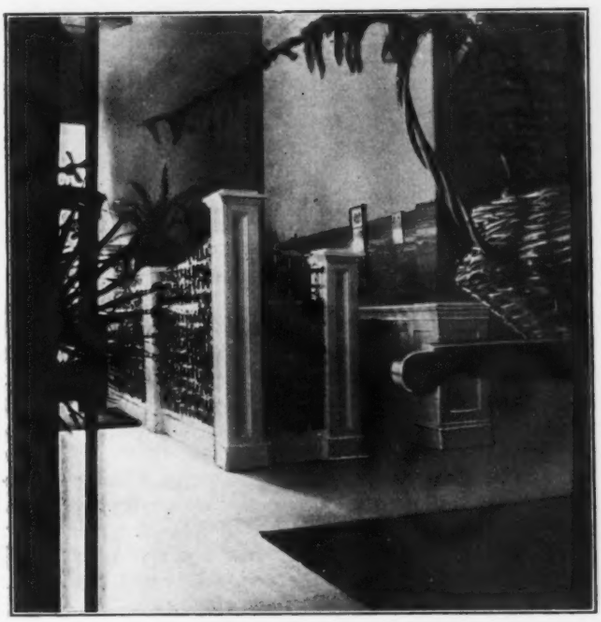


FIG. 1—THE CORNER "RETREAT," WHERE MANY CONTRACTS ARE SECURED

The shop and merchandise were first thoroughly cleaned and put in spick and span condition, then wistaria, smilax, hanging baskets, cut flowers and apple blossoms were generously used to make a veritable bower of the whole room, the delicate perfume of the apple blossoms lending a most delightful touch. Hidden in apple trees in the corners of the room, and responding to the music of the orchestra, were singing canaries that lent an illusion of springtime and appealed to everybody. The effect of this bit of stage craft on our guests was immediate and apparent; their curiosity was excited at once, and they looked for more wonders—and found them in the electrically prepared refreshments and the demonstrations of the many modern household applications of electric service.

Throughout the festival special days were set apart and featured separately. On Thursday afternoon there was a tango tea, well advertised and a great success. At 4:30 professional dancers entertained our guests with exhibition dancing, and both the refreshments and the music were "à la tango." The bread baked in the electric ovens was "tango" in color and made appetizing as well as delicious sandwiches, which were served with tea made in the electric samovars.

FIG. 2—COMFORTABLE CORNER IN THE KANSAS CITY ELECTRIC SHOP

In this way we attracted a large number of people to our shop who had never been there before. Some were our lighting customers, others were not, but I am sure that many of them soon became customers when they saw the many attractive, useful and comfortable electrical devices to be had, and at such "happy" prices. Many

FIG. 3—ANOTHER GLIMPSE OF THE SHOP DURING THE SPRING FESTIVAL

people became acquainted with our wares who had never "met" them before.

On Saturday afternoon a "kaffee klatch" gave us an opportunity to demonstrate the coffee percolators, and with the coffee we served German cookies, coffee cake, apple cake, and plenty of German music, giving the party a real foreign atmosphere. The guests themselves entered well into the spirit of things, and in this way the public's interest was sustained day after day.

The Fall Festival

The first spring electric show was so successful that we decided to have another such affair in the fall before the Christmas trade started. This second show was held Oct. 1 to 10 inclusive, and was called "The Fall Festival —Electric." Our sales during these ten days equaled those made during the whole month of December, 1913, which, of course, included the holiday trade.

During this fall festival we had two special features, a "matinée maxixe" and a "thé dansant," on Thursday and Saturday afternoons respectively—and such enthusiastic crowds! We endeavored to make these parties well worth an afternoon for any man or woman, and we succeeded—this in spite of the fact that the Electric Shop is situated fully four blocks from "Petticoat Lane," the shopping center.

In both these festivals the music had been quite a factor. In the second one we used each morning an electrically operated Edison phonograph, and in the afternoon Kelly's Orchestra of five pieces was present. The fact that Kelly furnishes the music for all the ultra-fashionable parties in Kansas City was most significant to every one—evidence indeed that we were going to have a "real" affair.

Our fall decorations were very pretty. Corn husks, pumpkins, wheat and goldenrod were used profusely, and the ceiling lamps were covered with transparent yellow pumpkins. At the time of the earlier spring festival we had used Japanese lanterns to cover these same lamps, giving them a soft Oriental effect.

On both occasions we invited electrical manufacturers and jobbers to participate, and each manufacturer and jobber had a representative and demonstrator here to look after the respective displays. We offered a discount of 20 per cent on all merchandise purchased during the show, and extended the privilege of paying for such merchandise in six monthly instalments. We have had very few "come-backs," a condition which, I believe, is due to the fact that, instead of the whole amount being "attached thereto," only a small portion was charged on the electric-light bill, and the purchasers were not frightened by the size of the first bill into bringing the appliance back.

At the preceding spring festival another feature was the giving away of three vacuum cleaners to the customers who guessed nearest to the number of transfers to be taken in by the street railway company on Easter Saturday, the last day of our show, the number taken in last year on the same day having been previously announced. This feature was not so popular as it might have been, for the customers seemed to have a very vague idea of figures and didn't give the matter much thought.

Regular office hours were maintained from 8 a.m. until 5:30 p.m., except on the last discount day, when we closed at 9:30 p.m.

We are planning another electric show for October of this year, which we expect to be even bigger and better than those that have preceded it. We have already succeeded, by means of the former shows, in educating a large number of Kansas Citians in the use of electrical devices, and the word has spread. I believe that we could have gone on for years using the ordinary methods without creating such an interest in household appliances, and that the continuation of these shows will do more for us than anything else we could attempt.

We find that the expense of such a show runs about

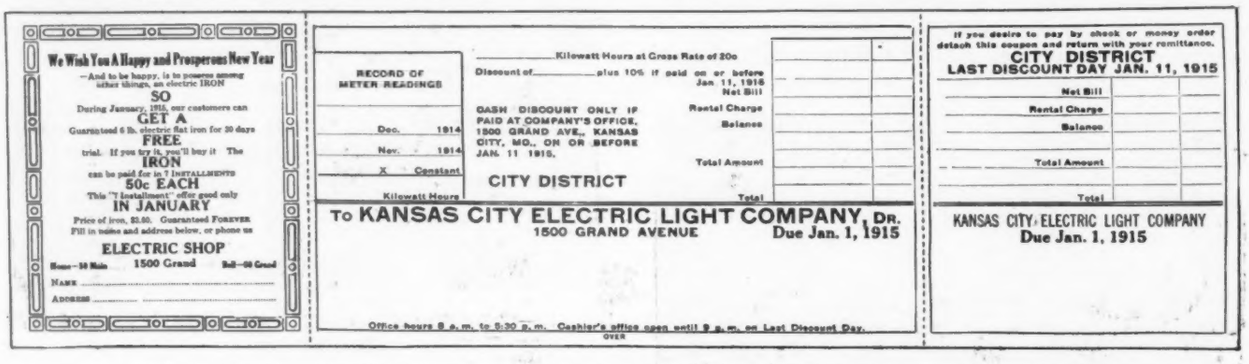

We Wish You A Happy and Prosperous New Year
—And to be happy, is to possess among other things, an electric IRON
SO
During January, 1915, our customers can
GET A
Guaranteed 6 lb. electric flat iron for 30 days
FREE
trial. If you try it, you'll buy it The
IRON
can be paid for in 7 INSTALLMENTS
50c EACH
This "7 Installment" offer good only
IN JANUARY
Price of iron, $3.00. Guaranteed FOREVER
Fill in name and address below, or phone us
ELECTRIC SHOP
Home—50 Main 1500 Grand Bell—50 Grand
NAME
ADDRESS
RECORD OF METER READINGS
Dec. 1914
Nov. 1914
X Constant
Kilowatt Hours
Kilowatt Hours at Gross Rate of 20c
Discount of plus 10% if paid on or before Jan. 11, 1915
Net Bill
CASH DISCOUNT ONLY IF PAID AT COMPANY'S OFFICE, 1500 GRAND AVE., KANSAS CITY, MO., ON OR BEFORE JAN. 11 1915.
Rental Charge
Balance
Total Amount
CITY DISTRICT
Total
To KANSAS CITY ELECTRIC LIGHT COMPANY, Dr.
1500 GRAND AVENUE
Due Jan. 1, 1915
Office hours 8 a. m. to 5:30 p. m. Cashier's office open until 9 p. m. on Last Discount Day.
OVER
If you desire to pay by check or money order detach this coupon and return with your remittance.
CITY DISTRICT
LAST DISCOUNT DAY JAN. 11, 1915
Net Bill
Rental Charge
Balance
Total Amount
Total
KANSAS CITY ELECTRIC LIGHT COMPANY
Due Jan. 1, 1915

FIG. 4—EVERY ELECTRIC-LIGHT BILL BEARS AN ADVERTISEMENT FOR THE ELECTRIC SHOP

$300, including music and decorations. But the shows have paid beyond our expectations. We do not seem to have dull months any more, and I attribute this fact to the good advertising we have received from the shows. I feel that it is quite an asset to any shop to have succeeded in bringing the people into the store on such an occasion, and to have them become acquainted with the merchandise in such a favorable way, whether they make any purchases at the time or not—then or later.

Figuring that every visitor has a circle of at least five friends whom she or he will tell about what was seen at the Electric Shop, how cheap the appliances are, and that they can be operated at such and such a cost, the shows "simply must" be the means of stimulating business for some time after each show. Certainly we have sold more of the "fancy devices," such as percolators, samovars and chafing dishes, since the shows, whereas our principal sellers before were irons and toasters. Also, we now have calls for hot-plates and ranges, whereas the orders for such devices before were very few. It pays to get the people into your store.

Arrangement of the Shop

Electrical devices, one might say, are still in their infancy, and hence we must encourage the public to become better acquainted with them. In our shop we have our "electric-iron table" close to the cashier's window, so that customers when paying their lighting bills have to walk around it. Very few men, women or children will pass that table without fingering the irons, taking a pamphlet, or inquiring about the size or price.

I do not want our shop to have the jewelry-store atmosphere. I watch our stock personally to see that the devices are not on the tables too long, and we keep them moving. If any of the devices become shopworn, we

have them re-nickeled or re-coppered. In so far as possible all appliances are displayed on tables rather than in cases. I believe that every woman feels a little reserved about asking clerks to take goods out of a case in order that she may look them over, whereas if they are on an open shelf or table, she can read the price and

VISIT THE ELECTRIC SHOW
SEE THE ELECTRIC WONDERS
AN easy and delightful object lesson in housekeeping and a feast to the senses — beautiful decorations, music, a taste of the dainties prepared by the electrical cooking devices. The demonstrations of things electrical at work are profitable suggestions of how to run the home more easily, economically and comfortably.
Every day of the show, March 25, to April 3, electrical utensils will be sold on easy monthly payments and at 20% reduction in price.
Electric Vacuum Cleaners Given Away
MONDAY, MARCH 29
March—The Popular Kid.
Selections—Chin Chin.
Waltzes—Cecile.
Popular Songs.
Selections — The Passing Show
Kansas City Electric Light Company
15th Street and Grand Avenue

FIG. 5—THE NEWSPAPER DISPLAYS CARRIED OUT THE SPIRIT OF THE SHOW

handle them at pleasure, just as she is accustomed to do in the department store.

The Employee a Sales Asset

We do no house-to-house canvassing, and pay our clerks a flat salary with no commission, relying on the popularity of our Electric Shop and the ideas it propagates and on our printed advertising. The writer considers the employees of the electric company her principal asset in making the electric shows successful. These employees are about 500 in number, and everything is done to make them as enthusiastic about the show as possible, so that they will talk about it to their friends and really believe in it.

We make every possible effort to keep our employees interested in everything electrical. When we get in a new stock of portable lamps I tell everybody in the building about it, and invite all to come and see the lamps and to criticise them. Before the shows, the Christmas holidays, or a wedding of one of the employees I send out some special letter suggesting the appropriateness of electric gifts, and many have remarked, "You don't let us forget the Electric Shop." Many of the employees bring their friends into the shop. A discount of one dollar is allowed employees on purchases of appliances—an offer which helps make many sales.

The matter of adjustments and repairs is important. I always give our customers the benefit of the doubt, and try to impress upon the clerks in the shop the fact that I am more pleased to find that they have gone a little farther than was necessary in an adjustment or in an argument about a repair charge than that they have let the customer leave the store with the feeling that he has been given "the short end of the deal." We make it a practice not to charge for repairing an appliance recently sold, unless it shows signs of having been used with gross carelessness. We suit the customer's desire, if possible. When I send a demonstrator with a vacuum cleaner he is instructed to inquire whether the housewife has an iron or a toaster and, if so, whether these are in good working condition. If they are not, the man repairs them then and there, if possible; otherwise he either brings them in to the shop or orders a call, and the truck stops next day. We fix up such troubles in most cases without any charge whatever.

In short, we are striving in every way really to popularize electric service in the home by making friends for our appliances. We are doing everything we can to further this end, but the Electric Shop has proved itself the most helpful influence, and by every means we can invent we make the Electric Shop interesting and comfortable. We have a cozy retreat screened off as a little reception room, for instance, where a customer may rest and feel at home. And here, as elsewhere, we set our stage as cleverly as we know how. In this rest room, in winter, the woodwork is dark and the decorations warm and cozy, while in summer the

DAINTY THINGS TO EAT AT THE ELECTRIC SHOW
MAR. 25 – Apr. 3
COME and have a real good time.—See what's what in electrical devices for the home—watch the demonstrations—enjoy a luncheon—hear good music. During this special exhibition many articles are offered at 20% reduction from regular prices.
Electric Vacuum Cleaners Given Away
Kansas City Electric Light Co.
15th Street and Grand Avenue
WEDNESDAY MARCH 31
March—Magdad
Selections—Sari
Hits From The Follies of 1914
Waltz—The Blue Danube
Hawaiian Songs
Music by Kelly's Orchestra.

FIG. 6—ANOTHER NEWSPAPER ADVERTISEMENT—NOTE THE MUSICAL PROGRAM

woodwork is refinished in white enamel, so that the whole effect is cool and inviting; and in this room many appliances are privately demonstrated and sold.

It pays. It pays to give the social touch to every public function and to give the necessary trouble and expense to please and entertain your guests.

An Electrical "Fourth" in Your Town

What the Central Station Can Do to Displace Dangerous Fireworks and to Promote a Safe and Sane Celebration of Independence Day

MANY progressive central-station men have long recognized that in place of the fireworks which brought the old-fashioned Fourth of July to a grateful close there might be substituted some sort of electrical display in connection with a civic celebration which would be more appropriate to the day and reduce the hazard to life, limb and property.

Although the idea of a safe and sane Fourth has been advanced and fought over year after year, to many the meager evidence of the growth of the idea is discouraging. Analyzing the reason why, one meets the question: What can be a suitable and satisfying substitute for the traditional blaze of evening fireworks so endeared to the American public?

Electrical Displays the Only Substitute

There is but one substitute appropriate and possible, and that is the use of electrical displays. When will the central-station industry as a body assume the leadership of this crusade and prepare to receive the profits that will surely follow?

Many progressive central stations have already taken a long step in the local popularizing of an electrical Fourth of July, and everywhere the innovation has met with marked success. The general public has become accustomed to the utilization of electrical displays for civic celebrations, and the way is well paved for the extension of the idea. Only concerted action by the central-station industry throughout the land is now needed to bring about the speedy adoption of the all-electrical, safe and sane Fourth of July.

Electrical set pieces and signs; festoons of red, white and blue lamp streamers in streets, squares and parks; the outlining of municipal and business buildings with lamps; colored flood lighting and scintillator effects spanning the heavens; patriotic moving-picture shows and band concerts in public places; patriotic tableaus lighted by concealed projectors; parades of electric vehicles, electrically lighted floats, and electric-lamp torches carried by marchers—these are but a few of the "stunts" which will suggest themselves to the live central-station man who sets about making the Fourth of July in his town an occasion of civic dignity and electrical beauty, free of any possible aftermath of missing fingers and charred ruins.

Last year, for example, New York City in every one of its boroughs had a safe and sane electrical Fourth, and the people thoroughly enjoyed it. So successful was that celebration that the city has authorized the expenditure of $10,000 on electrical illumination for this year's Fourth. Some illustrations of last year's illuminations are shown herewith. The lamps, wiring and energy for the illumination of the City Hall were furnished gratis by the New York Edison Company, which also supplied the energy for the rest of the illumination.

FIG. 2—OUTLINING ONE OF THE CITY'S LANDMARKS—THE WASHINGTON ARCH

Mayor John Purroy Mitchel of New York City, one of the stanchest advocates of reform in Independence Day celebrations, last week authorized for the ELECTRICAL WORLD the following statement:

FIG. 1—ELECTRICAL FOURTH-OF-JULY DECORATIONS IN COLUMBUS PARK, AN OASIS IN NEW YORK CITY'S EAST SIDE

"The safe and sane Fourth idea has come to stay in New York City. No city and no citizens have a right to endanger lives and property by celebrating national holidays with fireworks when electrical and other resources are at hand to make a safer and more brilliant display. It was with a deep feeling of gratification that one picked up the New York City papers last July 5 and noticed the striking absence of any long list of

FIG. 3—ILLUMINATION OF PLAYGROUND BUILDING AT SEWARD PARK, NEW YORK

dead and injured, or of homes destroyed as a sacrifice to the nation's birth."

The Deadly Fourth of 1914

If any argument were necessary to convince the local public or council of the necessity for taking stern measures to do away with the old-time pyrotechnic celebrations, one need only cite that the human sacrifices to the Fourth of July in the last twelve years have totaled 1832 dead and 40,954 injured.

In 1914 alone sixteen persons, mostly small children, were burned to death by fireworks; five persons were killed by firearms; three little boys died from lockjaw, six by explosions of gunpowder, guns or torpedoes, four by cannon, and five from blood poison resulting from injuries caused by fireworks. Among those injured but not killed thirty-six were totally blinded, thirteen lost one eye each, sixteen lost legs, arms or hands, and sixty-seven lost one or more fingers.

Set Pieces and Street Decorations

Electrical set pieces can be made as simple or as elaborate as the municipal purse or the designer's ingenuity

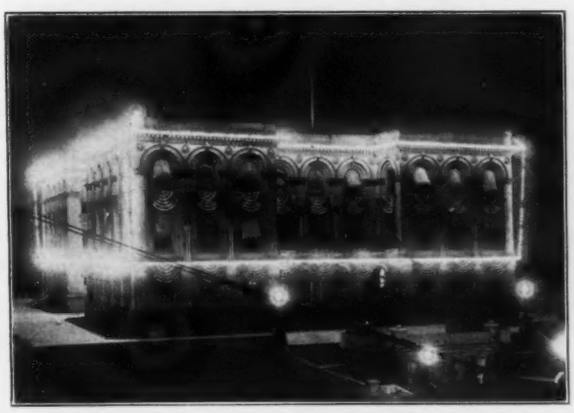


FIG. 4—OUTLINE LIGHTING OF BRONX BOROUGH HALL

will allow. Moreover, such pieces can be tested before using, thus insuring a perfect display.

Where streamers of colored lamps are to be installed, the merchants along the streets thus illuminated can be assessed so much per foot of frontage to help pay the cost of installation and energy. While the central-station's income in dollars and cents from the sale of energy for such a celebration may not be large, the resulting value in good-will and advertising need be limited only by the energies of the management.

And, with the main street a blaze of light on the night of the Fourth and a nest of shadows on the nights following, the opportunity to install permanent ornamental lighting later will be just what the central station cares to make it. No better "white way" argument could be offered.

The "White Way" as a Business Getter for the Central Station

Although the "white way" is recognized as a valuable asset by merchants whose stores front upon it, the fact that it is, in addition, capable of bringing new business to a central-station company is often overlooked. It has been the experience of the Public Service Electric Company of New Jersey that the installation of a white way promotes the sale of electrical energy to merchants established along it. The town of Union, N. J., situated on the Palisades directly opposite New York City and having a population of approximately 30,000, recently opened a "white way" on Bergenline Avenue, a street about one mile in length and lined on both sides with modern stores. The installation consists of about forty

GAS-FILLED "WHITE WAY" UNITS IN BERGENLINE AVENUE, UNION, N. J.

1000-cp gas-filled lamps, and the opening of the "white way" was made the occasion of a popular celebration lasting one week. Merchants' parades, band concerts, contests of various kinds and a general carnival spirit were in order for the period mentioned.

As a result of the installation of this "white way," many merchants were stimulated to greater eagerness, and four electric signs were installed, five "live prospects" for electric signs were developed, five merchants were induced to improve their window lighting by the installation of modern equipment, and at least a dozen others are contemplating a similar move. As there was one vacant store along the "white way," the Public Service Company took temporary possession, installing modern window lighting and utilizing it during the recent "Hot Point Week." This made an unbroken line of store windows through the entire district.

The company feels that the installation of a "white way" can be used as a strong closing argument for up-to-date store and window lighting and electric signs. Experience shows, however, that it is best to make the greatest efforts several months before the opening of a "white way," attempting to induce the merchants to make their stores appear as big and prosperous as possible. A month after the installation of a "white way" it is found that merchants are not nearly so susceptible as several months before.

The Way to Pay the Salesman

Some Interesting First-Hand Experience Recounted by Those Who Have Tried the Salary-Plus-Commission Plan

HUNDREDS of dollars have been spent on sales-department systems and equipment. Thousands of dollars are annually paid for men of genius and experience to direct the selling staff. But how much attention has been given by the average central station or electric shop to the vastly more important issue of the way to pay?

For, after all, it is largely on the happiness and the enthusiasm of the men and women who sell the goods that the measure of results depends, and happiness for every one of us is based very largely on our personal prosperity and the degree of hope which our apparent opportunity holds out to lure us on. It is well enough to train the salesmen, to build up an organization spirit, to supply the spur of inter-competition and invoke the ardor of a campaign, but the yearly average of production must still be conditional on just two things—the kind of men you hire and the way they work. The buying of the merchandise, the planning of the store, the training of the men themselves, and the advertising influence that supports the whole are—one and all—quite secondary in importance to that underlying, fundamental source of stimulus and sustenance, the salesman's pay.

The matter is not one to be longer left to habit and tradition, as recent experience among the properties of Henry L. Doherty & Company has well proved. Here is interesting evidence and testimonial from a number of these companies that have recognized the vital influence of the compensation system, and have made the best of it.

The "Doherty Commission Plan"

Almost a year ago, when the European war was first felt so keenly in this country, every company operating public utilities was forced by the state of the bond market to husband its resources and to take quick measures of economy. To avoid the possible necessity of reducing the very large staff of salesmen engaged in local work among the Doherty properties, Henry L. Doherty & Company instituted a new system of remuneration to all their selling men. This was a salary-plus-commission plan that decreased materially the direct outlay of cash, except for actual business gained, but at the same time offered added opportunity to every salesman based on his productiveness. The response was positive and quick, and the results soon proved these four things:

1. That a commission paid on sales soon stimulates an able man and brings out all the good that is in him.
2. That a commission compensation will promptly detect and discourage the unproductive laggard and eliminate him shortly from the staff.
3. That a nominal salary is a necessary feature of the system as it properly pays the men for necessary work that offers no return through a commission.
4. That the proper combination of both salary and commission makes a happy family and exerts a healthy influence on the market.

Experience at Meridian, Miss.

The details of this plan are well described in the words of Mr. John O. Chappell, manager of the new-business department of the Meridian (Miss.) Light & Railway Company.

"We put the new salary-plus-commission plan into effect on Oct. 1, 1915," says Mr. Chappell, "paying a straight salary of $50 per month, plus commissions on all electrical devices and gas appliances sold. The commissions ranged in amounts from 25 cents to $10—depending on the price and energy consumption of the article sold. If a sale is closed on the floor, the representative in whose territory the appliance is to be connected receives his regular commission, provided that he establishes the fact that the purchaser was his 'prospect' and that he had called upon him within thirty days prior to the closing of the sale. This fact can easily be determined by referring to the salesman's call sheets. When the plan was adopted every detail was thoroughly explained to the men, and they accepted the new arrangement with confidence that their sales would increase and that their compensation would equal if not exceed their previous straight salary of $75 per month. As a matter of fact, on the average, their combined salary and bonus has exceeded that amount.

"As soon as the plan became operative we noticed that sales were stimulated and that the representatives showed themselves constantly on the alert for new customers. At the outset a tendency to neglect smaller matters in the natural eagerness to win the larger business became apparent, but this fault was soon corrected, and the system shortly developed the conspicuous advantage of causing representatives to canvass with a greater degree of regularity—this being their best means of supplying themselves with names of possible customers. The plan also has a decided effect in favor of reconnecting dead services, especially where service had been discontinued on account of high bills caused by old worn-out and inefficient appliances. The representatives have a splendid talking point here, and if successful in selling, the results are doubly to their advantage.

Analyzing the Salesman's Work

"We have found the salary-plus-commission basis a wonderful means for proving or disproving a man's ability to transact good and substantial business, because it will disclose whether or not he is selling for the money only. Should he consummate a sale just for the money he personally gets out of it, he is prone to make misstatements and false representations which will later prove very embarrassing to him. Therefore the commission plan has the distinct advantage of enabling the manager to separate the wheat in his department from the chaff. For a man's work is judged not only from the volume of sales but from the character of business transacted and the number of 'come-backs' as well.

"We teach our men that every order must be complete and so taken as to set forth in application every term and condition of sale as a record for future reference; and we require representatives to keep in close touch with the credit department and familiarize themselves with the consumers' ledgers. The personal interest which their commission compensation gives them now has strengthened this feeling of responsibility materially."

Various Plans Tried in Denver

The Denver (Col.) Gas & Electric Light Company has long been interested in ascertaining the influence exerted by allowing the salesman to participate in the fruits of his work. Mr. Clare N. Stannard, in discussing the experience in the Colorado capital, says:

"This company has operated at various times under numerous plans of compensation for its representatives. For instance, we originally tried a straight commission plan, followed by a small-salary and commission plan. The next scheme was on a point basis, and then we changed to a salary covering a twelve months' period with an arrangement for the representatives to share in the profits of the new business secured during the year. Then later we paid a partial salary, the representatives sharing in all increased revenue secured by them from month to month, this share being estimated on a 5 per cent basis. This plan worked out very satisfactorily, because the representatives were then interested primarily in securing revenue for the company, either through the sale of appliances, through holding business, or through increasing revenue on present equipment, in which, of course, we are most interested.

"At present the men are working on a salary-plus-commission plan, the company feeling that the salary should reimburse the men for the work done by them not covered on the commission basis. The salary item covers, for instance, the securing of service applications and contracts covering gas and electric meters, the adjusting of high bills, the settling of complaints, the securing of additional consumption on present installations, etc. The commission is allowed on the selling price of gas ranges, water heaters, electric signs, various electric appliances, flat-rate and motor-service contracts taken, etc. I believe it is the consensus of opinion of those operating under this plan that the representatives are much stimulated through selling appliances and taking contracts on which good commissions are paid and watching the commissions accumulate from day to day. We have always observed that the more they have the more they are anxious to secure.

"The plan has worked out very nicely, for statistics show that on a per man basis we are this year selling a greater number of appliances than during the previous year, though we are not at this writing quite sure whether the additional appliances will bring us increased revenue, for on the present system it will be seen that the representatives are not nearly so greatly interested in revenue secured as under former plans, but are more interested in appliances sold. This might be considered a weak point in the system. On the whole, I do not feel that this scheme gives present consumers quite the attention that they received under former plans, nevertheless, in view of existing conditions, the present basis is an excellent one and is working out quite satisfactorily."

An Aid to Sales Efficiency

Mr. B. F. Noble, manager of the commercial department of the Montgomery (Ala.) Light & Water Power Company, adds some interesting points in regard to the assistance which any definite record of the value of sales affords the sales department. He says:

"The salary-plus-commission plan has worked out successfully in Montgomery. We are beginning to open up quite a number of new fields for appliances which were practically unheard of here before, and the change has not tended to cause any of our men to neglect customers or dead services. In fact, it has made the men realize that they have to attend more closely to the wants of each customer in order to secure more business. Taking our comparative figures on the amount of business secured for the past six months and the same six months last year, and putting them on a percentage basis, the result shows that 40 per cent of the force this year did 70 per cent of the total amount of business done by the force last year. This means that each man has worked at least 50 per cent in advance of the year before.

"As we look at it, this change has put the new-business men where they know their maximum efficiency. It is now possible to determine within a very close figure whether an additional salesman will pay for himself, and we do not hesitate to put on an additional man if we find it to be justified. In the future the force of the new-business department will depend more on the amount of new business to be secured than on the business a certain number of men can secure. Heretofore men were hired in haphazard fashion just because somebody thought we needed them. Now men will be employed with a clear field in front of them. Another result of this change is the fact that every salesman is taking an active and lively interest in the welfare of the new-business department and the amount of actual profit that is made. Instead of a man's working for his own benefit, he is now working for his own benefit plus his desire to put the new-business department he is working for on a paying basis. He realizes that it is up to him to make the department 'a go.'"

Induces a Higher Standard

Mr. A. K. Young, new-business manager for the Toledo (Ohio) Railways & Light Company, is also particularly enthusiastic over results seen in that city. He writes:

"Our new plan of salary-plus-commission is working out very advantageously for the men and for this company. From the start it was a success. When we first announced the change from simple salary the men were just a little bit dubious, but they were willing to experiment and started out energetically to give it a fair trial. To-day they are making more direct sales than ever before. They are also selling appliances that they never gave the slightest attention to before. Personally, I think it is the very best thing that could have happened for our new-business department. I am proud to say that we did not lose a man through dissatisfaction with the result, and they are certainly better salesmen now than they were six months ago.

"Moreover, it has served to open my eyes as to the ability of some of the men in the department. When I say that we sold $17,200 worth of merchandise through the efforts of our new-business department last month you will understand that they are working. Of this amount, $9,200 was for vacuum cleaners, which I think very exceptional, for these are cleaners that cost $50 and up. The new compensation policy has had a tendency to influence the men toward selling higher-priced articles. We are now selling electric ranges at from $60 to $110, and washing machines at $70 to $100, whereas in the past, under the old system, the men were more or less afraid of these articles on account of the high prices."

The Opinion in Salina

Another Doherty new-business manager, Mr. B. E. Jack, of the Salina (Kan.) Light & Power Company, comments further on the need for careful scaling of the commission schedule to induce proper attention to the appliances of best revenue-producing power. He says:

"I have believed for a long time that this was the only basis under which a central station should pay its new-business men. It spurs the laggard to higher speed and gives the 'rustler' a chance to make a better salary. It encourages the good man and puts the poor man in a place where he has to 'make good' or get out.

"The plan has worked out well here, and we have found it very satisfactory. At first the men were skeptical as to its value and did not welcome it, and for the first month they did not make very good salaries, for the apparent reason that they had only small numbers of 'prospects' lined up. Hereofore, in selling appliances,

all the men worked along lines of least resistance and confined their efforts to the sale of the leading appliances, such as small electric motors, vacuum cleaners, electric washing machines, etc. Now every man is anxious to sell everything that we have to sell, and as a result we are marketing many different kinds of appliances. We find that this, in itself, has had a wonderful effect on our general business, because it is advertising electric and gas appliances on a much greater scale. We are trying to teach our electrical customers that we have an 'electric store' first and a place to pay their bills second.

"We have found only one objection to the salary-plus-commission basis of compensation, and that is this: Many of the appliances sold are those which produce very little revenue for the company, but their prices make it very desirable for the salesman to sell them. Take, for instance, the electric washer. The one we sell is priced at $75, and the amount of revenue we obtain from it would probably be about 30 or 40 cents a month, while the same amount of energy expended on selling an electric sign would probably bring ten times the revenue. Some of the companies have some sort of basis for paying for the sale of electric signs or flat-rate windows other than the commission on the installation price. This makes it more attractive to the salesman. However, we find this present plan causes very little or no tendency toward neglecting present customers or 'dead services,' because, after all, they are our best 'prospects' for appliances. On the whole, we believe, it is putting the department on the right basis, and as time goes on will become more and more successful."

The Influence of Success

This subject of paying salesmen is extremely interesting and well worth the serious study of all central-station commercial managers. The opinion of the Doherty managers is not unanimous on every point, but all agree that the commission offer is an influence of great stimulative value, and that as such it should be utilized by every man who hires a salesman. For, after all, the sole objective is production, and the employer is ready and willing to give the man who sells the goods a proper compensation. What matters it, then, in just what form the money is reckoned?

One often hears men say: "I won't pay commissions. If a man won't work for me on a salary and do his best, I don't want him any longer."

But that attitude is neither intelligent nor efficient. "His best" stands for quite a variable degree of proficiency, entirely contingent on the salesman's state of mind; for when a salesman is discouraged and dissatisfied "his best" sells less by far than "his best" at other times when nerve is good and hope is high. The man who feels himself to be succeeding, and who is confident that he is getting on, has twice the power for production. It is not a matter of honesty; it is a matter of mental energy. Starve your body and you lose your muscular strength; fail to feed your enthusiasm and your hope and you must weaken in your eagerness and your initiative. It is nature's law. There's no appeal.

A Trial Will Convince

By installing large nitrogen-filled tungsten lamps in front of merchants' stores, and leaving the lamps over night for demonstration, the Reeves-Elebash Electrical Company of Tuscaloosa, Ala., reports that it has been easy to induce merchants to purchase lighting outfits since in this way the prospective purchasers prove to their own satisfaction how light attracts customers.

Motor Drive in a Rock-Drill Factory

BY FRANK D. BURR

The Denver Rock Drill Manufacturing Company, of Denver, Col., manufactures a general line of rock drills used in the excavation of rock underground, in mining operations, and in open quarry work. The Waugh valveless construction employed utilizes the piston hammer, which is a solid piece of steel, to perform the duties of both valve and hammer by covering and uncovering the ports which control its reciprocating motion. The machines themselves are constructed of alloy steels and alloy-steel forgings throughout, each part being scientifically heat-treated. An electric-air drill is also built. This machine, which is highly efficient, is really a self-contained motor-driven air compressor which drives its own drill.

A total of 354 hp of connected motors is used in the factory of the Denver Rock Drill Manufacturing Company. The forge shop, for example, is driven by a 35-hp, 220-volt, three-phase General Electric motor which is belted to a group of machines consisting of two Northampton emery wheels, a 5-in. American blower, a 2000-lb. Billings & Spencer drop hammer, and a Billings & Spencer trimming press. By means of dies the drop-hammer cuts the parts into the required shape. When the hammer strikes the metal flows, forming a rough finish, so that trimming dies are necessary in order to cut off the flash.

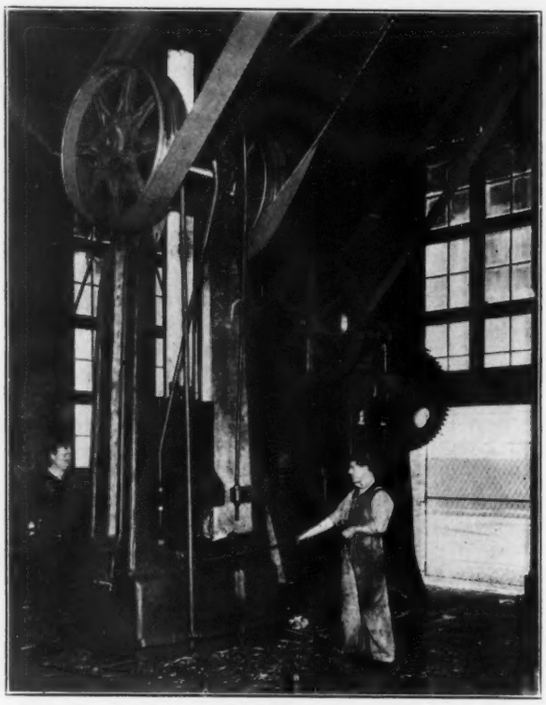


FIG. 1—A 2000-LB. AIR-OPERATED DROP-HAMMER AND TRIMMING PRESS

The forgings are heat-treated, being quenched from the proper temperatures and then annealed, which puts the metal in the most desirable condition for machining. The heating is done by means of oil furnaces. In order to produce very intense heat, a blast is obtained by 15 hp of motors driving six Buffalo blowers. The oil supply tank is placed below ground and contains 21,000 gal. The oil is heated by steam, supplied by an 80-hp return-tubular boiler, to a temperature which gives the required fluidity at the nozzles.

From the annealing process the metal parts go to the pickling tank, where scale is eliminated and defects are

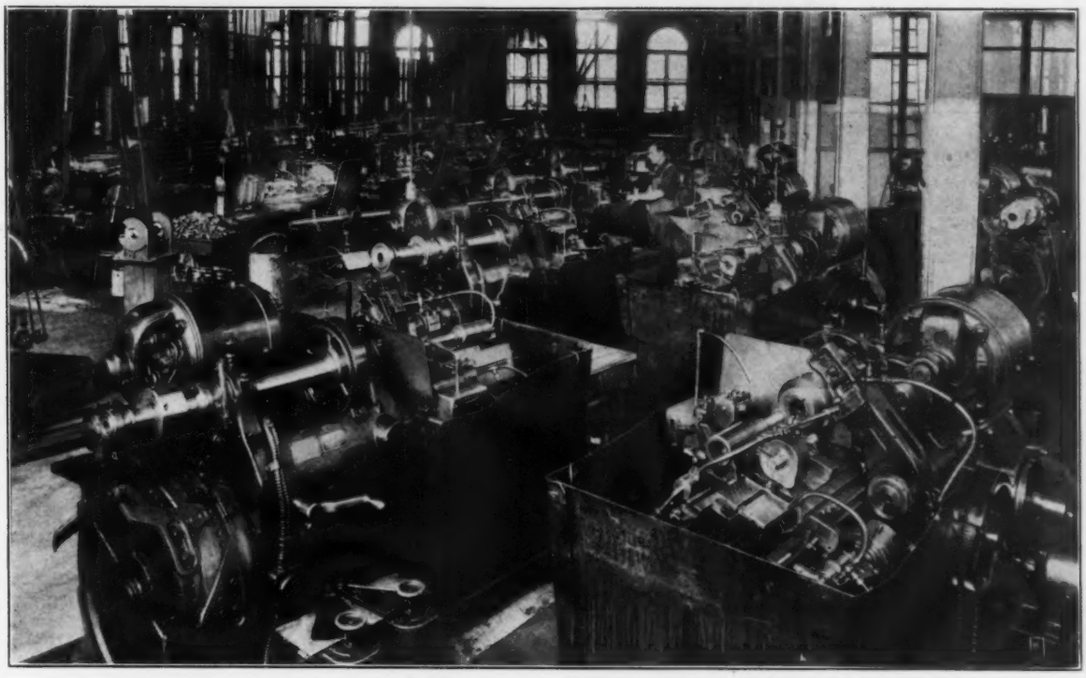


FIG. 2—SOME OF THE MOTOR-DRIVEN AUTOMATIC MACHINE TOOLS

shown up. After this process they are checked by the inspectors. The parts are then sent to the machine shop, where the necessary operations are performed by milling machines, lathes, drills, Gridley automatic chucking machines, Barr machines, etc. Ten of these automatic machines are equipped with individual drive, two motors being mounted on each machine. One motor drives the spindle, while the other operates the feed. These are direct-current motors, energy being supplied by a 75-hp motor-generator set. Usually twelve to fifteen operations are necessary for each part to be machined. The single-spindle machines contain four tools, which are

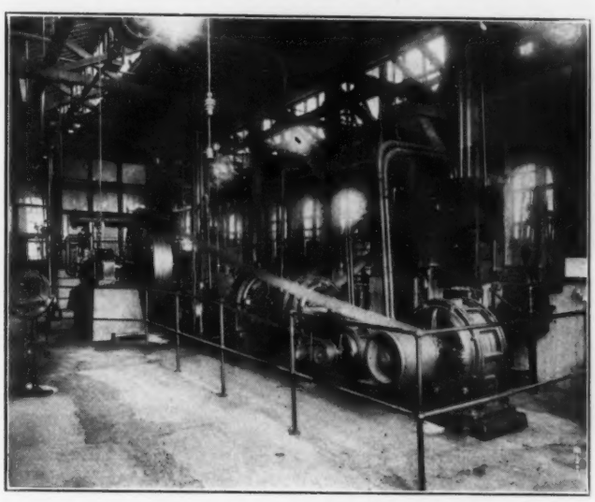


FIG. 3—MOTOR-GENERATOR SET AND 100-HP MOTOR DRIVING AIR COMPRESSOR

automatically applied in succession to the parts to be machined.

After being machined, parts to be carbonized are placed in large iron boxes, filled with carbonizing compound. The boxes are placed in the oil furnace, where pyrometers having platinum and platinum-rhodium thermoelectric couples enable the temperature to be kept constant at 1750 deg. Fahr. The parts are next transferred to the hardening and tempering furnaces, being first treated in pre-heating furnaces. Some of the pieces receive a double-heat treatment, depending upon the particular part to be treated and upon the quality of material from which it is made. After the heat treatment for hardening purposes the parts are treated with the sand blast, which takes off the oil that has been baked on. Next the parts are ground to fit, and are then passed to the inspection department for examination with gages and micrometers, in order to insure exact measurements. Finally the parts are assembled, forming the air drill, and taken to the testing department.

The drill steels are made up by means of a drill-sharpening machine which consists of an air-operated vise for gripping the steel while the bit or cutting edge is being made by a "dolly" of suitable form which is driven against the end of the steel by an air hammer. The air for this work is supplied by a 20-in. by 12-in. by 12-in. Laidlaw-Dunn-Gordon air compressor driven by a 100-hp, 220-volt motor.

Compressed air is also used to operate the air hoist which lowers and raises parts to and from the oil bath, to blow away metal chips during the machining processes, and to operate a 1500-lb. Erie steam hammer.

Electrical energy to operate the factory of the Denver drill company is purchased from the Denver Gas & Electric Light Company.

Toasted Marshmallows Sold Grills

At the recent 1915 "Made in St. Louis" show the Union Electric Light & Power Company of St. Louis offered standard five-dollar electric grills for $3.95. Perhaps because other booths were offering bargains and this one as a result did not loom up large, or perhaps because the grill offer simply wasn't noticed by the crowds, the electric grills at the outset did not sell rapidly. Observing this, someone conceived the idea of toasting marshmallows on a grill and serving them to the visitors at the show. As a publicity measure the scheme worked from the beginning, and after that the company had no difficulty in selling electric grills at $3.95.

A 6000-KW ELECTRIC ENAMELING LOAD

Superior Results Obtained at Overland Automobile Factory, Toledo, Ohio, by Use of Radiant Heat from Resistors in Electrified Ovens

To enhance the quality of its enameled product, to increase the production of its present plant, and to eliminate the risk of gas explosions and fires, the Willys-Overland Company of Toledo, Ohio, is remodeling its steam and gas-heated enameling ovens and is equipping them for electric operation. Some of the electric oven heaters have already been installed, and tests made for comparing the results obtained from gas and from electric operation indicate that electric heat produces brighter and smoother enamel, which when cooled reaches the exact degree of hardness desired. The increase in production to be obtained on account of the shorter time required for electric baking has been conservatively estimated at 40 per cent, but may in some ovens reach 60 per cent or more. The gross cost of heating the ovens will be increased about 35 per cent with electric operation, but the enameling cost per unit of material will be appreciably reduced because of the increased production, lowered labor charges, economy in floor space, reduced insurance rates and other advantages.

TABLE I—MISCELLANEOUS DATA ON OVERLAND ELECTRIC ENAMELING OVENS

Total number of ovens to be electrically heated	20
Total cubical content of ovens, in cu. ft.	52,400
Total weight of metal in all ovens per bake, in lb.	70,000
Metal to be handled per day (tons)	175
Total connected load, in kw	6,000
Dimensions of largest oven, in ft.	16 by 36 by 7.5
Rating of heaters in largest ovens, in kw	400
Dimensions of smallest oven, in ft.	12 by 14 by 7
Rating of heaters in smallest oven, in kw	240

Electrical energy for operating these unity-power-factor, high-load-factor ovens, as well as for driving practically all machinery in the Overland factory, is delivered from the Water Street station of the Toledo Railways & Light Company over three No. 3-0 paper-insulated, underground cables, operating at 23,000 volts. These cables, which are about 3.5 miles in length, terminate in a newly erected transformer station, the present rating of which is about 11,000 kva. The factory distribution system operates at 440 volts.

TABLE II—COMPARATIVE TEST DATA ON OVENS

	Heated by Gas	Heated by Electricity
Oven dimensions, in ft.	21 by 21 by 7.5	21 by 21 by 7.5
Tons of metal in ovens	1.75	1.75
Time of first bake (hours and minutes)	1:30 to 1:45	1:00 to 1:05
Time of second bake (hours and minutes)	2:30 to 2:45	1:20 to 1:30
Cu. ft. of gas used in first bake	2340	....
Cu. ft. of gas used in second bake	3340	....
Kw-hr. of electrical energy for first bake	....	225
Kw-hr. of electrical energy for second bake	....	245
Total gas used, in cu. ft.	5680	....
Total electricity used, in kw-hr.	....	470

The enameling ovens are not installed in a single group, but are placed at such locations in the factory as to be advantageous from the standpoint of economy in labor in handling the partially completed automobile parts. Each oven or group of ovens is fed from a 440-volt, three-phase, twenty-five-cycle line, operated through a contactor control panel of special design.

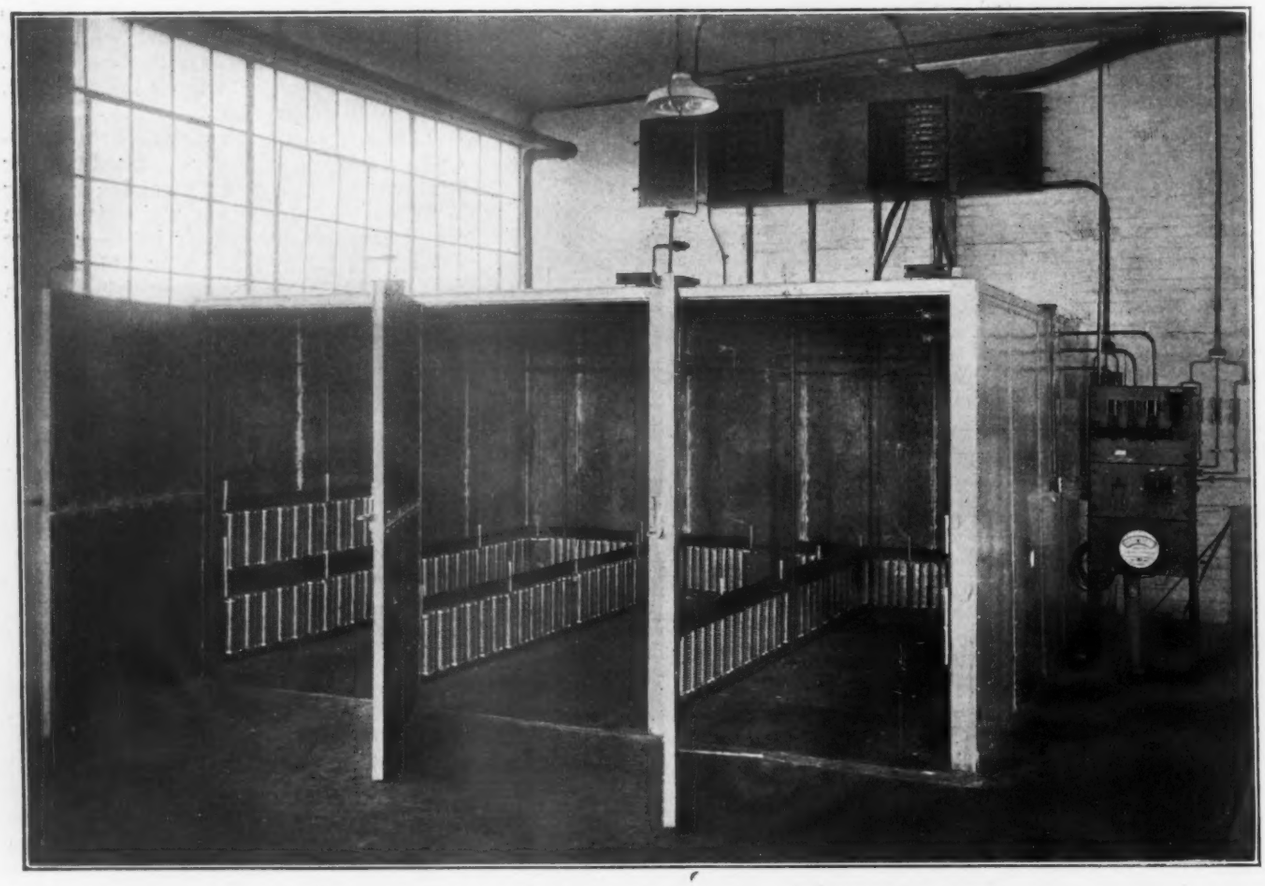


FIG. 1—SMALL OVEN USED FOR ENAMELING WIND-SHIELD FRAMES

On the panel there is a three-pole, 440-volt main-line contactor for the heating circuit; a reversing contactor to insure keeping the 110-volt control circuit operative at all times; a contact-making pyrometer instrument to adjust and maintain correct and even temperature automatically, and a double-pole, single-throw knife switch in the control circuit. Except for two details, the complete wiring diagram of this panel is shown in Fig. 3. One of the details not shown is the pair of leads. These, in series with the control circuit, are taken from the panel through sturdy door switches, rendering it impossible for the interior wiring of the oven to be energized while the oven doors are open. The second detail not shown is the 6-volt auxiliary circuit within the pyrometer instrument on which the pyrometer needle contacts are made and broken. A potential lower than 110 volts was needed in this instrument to eliminate arcing, which might burn the needle contacts.

All of the wiring inside the ovens now completed is bare. The three-phase, 440-volt, solid-copper, round buses are mounted along three of the walls near the ceiling. The heating units are placed on the floor along the two side walls and down the center of the oven and are connected to the 440-volt lines, as indicated diagrammatically in Fig. 3. Connections to the heaters in each furnace are arranged to balance the three-phase load. Each individual heating element is rated at 11 kw, and without the sheet-iron guard which is used to protect the heater ribbon from dripping enamel each unit measures 16.25 in. high by 32.25 in. long by 3.25 in. wide. The units require no space that could be used for enameling stock, and all the heaters are placed so as not to interfere with the free movement of the operators who set and remove the metal stock.

Data given in Table II show the comparative amount of gas and electricity required for ovens of like dimensions. No changes had been made in the electrically equipped oven except to remove the open-flame gas heaters and to install electric heaters. Results considerably better than these, however, are expected of the

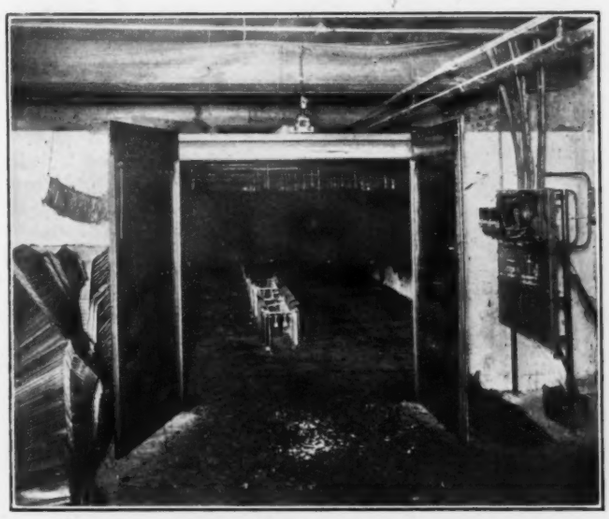


FIG. 2—MEDIUM-SIZED OVEN PARTLY FILLED WITH AUTOMOBILE HOODS

more recently remodeled electric ovens, because their walls are made of 1-in. sheets of "Nonpareil" high pressure block flanked with No. 20 gage sheet iron as a cover.

Much of the reduction in time of baking shown in Table II is attributable to the fact that the excessive ventilation necessary with gas heating is not needed with the electric process. Old gas ovens, which required eight 10-in. by 28-in. vents to carry off flue gases, are now being operated electrically with all but one of these vents closed completely and that one partly closed all of the time. Attempts to "speed up" the gas-heating process to make it equal the electric, it is said, made the enamel shrivel on the metal.

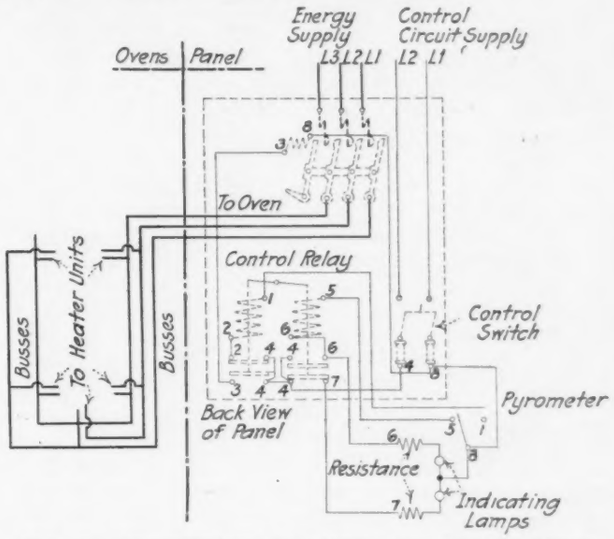


FIG. 3—CONNECTIONS OF PANEL AND ARRANGEMENT OF OVEN BUSES

Heating engineers of H. L. Doherty & Company, who operate the Toledo utility company, claim that much of the success of the electrical installations is due to the fact that radiant heat instead of convected heat acts in the electric enameling process. Convection currents carrying dust are almost eliminated.

All of the ovens have been or are being overhauled under the direction of Mr. W. A. Hill, electrical engineer for the Willys-Overland Company. The electrical equipment is being supplied by the General Electric Company, and the heat insulating material is being furnished by the Armstrong Cork & Insulation Company of Pittsburgh, Pa.

Selling Gas-Filled Lamps in Nebraska

A lamp salesman recently induced the central-station manager in the little town of Creighton, Neb. (population about 1500), to order a 750-watt gas-filled tungsten lamp for advertising purposes, and the central-station people were discouraged after having installed the lamp in the Chautauqua tent to find it little noticed. Shortly after, however, the company saw its chance, and one night, when one of the church societies was giving a bazaar and supper, the lamp was installed in front of the building, thus competing with the gasoline system there in use. According to the secretary of the company, people thought there was a fire in that part of the town. Everybody talked about it.

The company, however, was energetic and wished to push the matter further, and the proprietor of a poorly lighted grocery store was offered this lamp for use over the holidays, provided only that he paid for the energy consumed. The grocer accepted, and the sales department then re-discovered the old, old truth that the shortest road to a contract is often by way of a competition. The next day the proprietor of a gasoline-lighted department store, having noticed the grocer's illumination, made inquiries which led to an installation of 2 kw. And the grocer continues to use nitrogen-filled lamps.

Merchandising Methods

Selling an Iron a Minute in Birmingham, Ala.

Six hundred and fifty electric irons were sold in ten hours by the Birmingham (Ala.) Railway, Light & Power Company on "Birmingham's Dollar Bargain Day."

To stimulate trade and to make the people more familiar with the city's shops the merchants of Birmingham, aided by a newspaper advertising campaign, decided to set apart one day on which everybody would place on sale some one article or articles specially priced at one dollar. The central-station company's one-dollar bargain was a standard electric flatiron, only one iron being allowed each customer. Of the 650 irons sold, it was estimated that but few left the city and that at least 450 were placed in service at once. It was also felt that the sale, besides sowing seed for future business, offered a great opportunity for showing the benefits of electric service and the uses to which electricity can be put.

Purchasing Appliances for Retail Sales

The man to whom is intrusted the work of purchasing appliances to be sold to the public must be versatile in experience and have the necessary knowledge to enable him to supply the demands of both discriminating customers and the operating department of his company, said Mr. Galen Crow, commercial agent of the Oklahoma Public Service Company, in an address on merchandising methods before the recent Oklahoma convention.

His purchases must be confined to those articles the use of which has been approved by the proper authorities, said Mr. Crow, and all such devices and appliances should be standardized only after demonstration by approved tests by reputable manufacturers. This method will insure satisfaction to all departments of the central-station company and to the consumer.

It is good practice and good business, continued Mr. Crow, to adopt and standardize for use some particular line of standard manufacture, and to adhere closely to this standardization, avoiding the dissatisfaction which is bound to result when stock is made up of numerous types and patterns of untried, untested articles, which may eventually find an expensive resting place in the junk barrel.

If this practice is followed and maintained, original packages can be purchased, thus obtaining the maximum discount allowed to the manufacturer and so enabling the business to be carried on with a smaller amount of investment.

An Outlet for Used or Shopworn Appliances

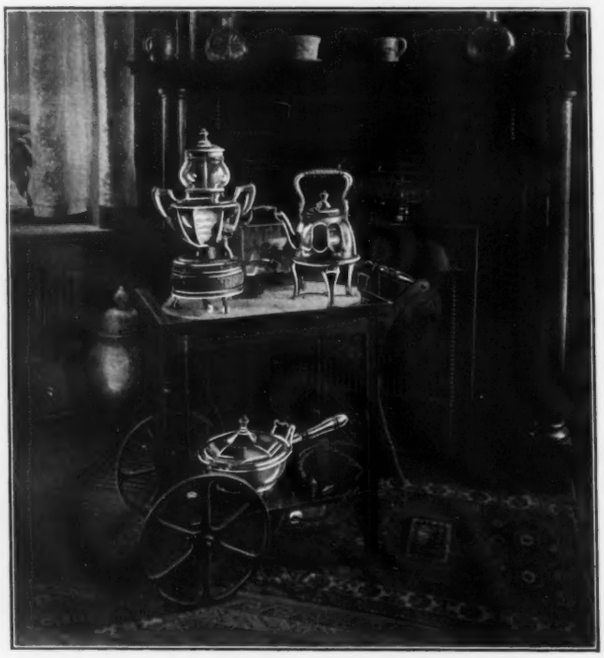
Whenever a church or the Young Women's Christian Association in a certain Ohio town holds a bazaar the central-station company takes advantage of the occasion to rid its shelves of "dead" stock. Appliances which cannot be sold readily in the company's salesrooms are disposed of at low prices to the organizations giving the bazaars. The appliances are then resold to the public at prices which return some profit, which is used for church or charitable purposes.

The plan has several advantages. It prevents "slow-moving" stock from accumulating; it eliminates the necessity of giving large donations of money to the organizers of bazaars and fairs, and yet holds the good will of these organizations; it puts appliances on the company's lines, and it advertises and popularizes electrical appliances.

Portable Serving Table Wired to Promote Use of Appliances

Approximately 8000 customers of companies operated by the Light & Development Company of St. Louis, who live in towns scattered through the Middle Western States, have recently received a 5-in. by 8-in. double-leaf folder describing and illustrating the "home electric coupé" shown in the accompanying picture. In the text of the pamphlet these tea carts or portable serving tables, each wired with three sockets to accommodate a percolator, a toaster and a chafing dish, are offered to the company's customers at one-half actual cost if the patron purchases the appliances to go with the table. The tables will also be sold at actual cost to customers who already own three appliances.

In recommending the tables to customers, Mr. W. A. Smith, vice-president of the company, explained in the



MRS. "BILL" SMITH'S "ELECTRIC COUPÉ"

pamphlet: "I don't own an automobile—I can't afford it—but my wife does own what she calls her electric coupé. It is a wonderful convenience, and she often uses it for cooking the entire meal at the table. Percolated coffee, chafing-dish mushrooms on electric toast, and a salad is not a bad meal, is it?"

The text of the pamphlet is addressed to the customer and is signed by "Bill Smith," as is all of the company's advertising literature. The advent of such a conveniently arranged table into appliance owners' homes will, it is believed, cause the appliances to be used more frequently.

Novel Uses for the Vacuum Cleaner

New fields for the sale of electric vacuum cleaners were brought to the attention of the Texas Power & Light Company, Dallas, Tex., by the discovery that these machines were being used for pool-table cleaning and for removing loose hair from horses. The use of an electric vacuum cleaner for cleaning pool tables was noticed by one of the company's employees in a Dallas pool hall. On entering, his attention was immediately arrested by the bright, clean appearance of the tables, and he was exceedingly surprised when, at the finish of the game, the proprietor brought out

a vacuum cleaner and made good use of it on one of the tables. The proprietor maintains that the "electric way" is the best, being more thorough and preserving the felt.

The value of the vacuum cleaner for removing the loose hair from freshly groomed horses was discovered by a livery man who found that this improved method of bettering the appearance of his horses pulled business to his stables. He advertised that his horses were electrically groomed and that therefore his patrons would not be annoyed by horsehairs shed upon their clothing.

Free Fan and Toaster Service for Indigent Invalids

Following their usual custom of lending electric fans to invalids whose circumstances do not permit paying for such hot-weather comforts, the properties of H. M. Byllesby & Company have renewed the offer for the summer of 1915. This year, in addition to fans, electric toasters will be loaned free of charge if the attending physician in the case notifies the company of the inability of the patient to pay for such service. Electric-toaster service has been offered this year because toast is a necessary article of diet for nearly all invalids and because wholesome and appetizing toast is difficult to prepare with ordinary cooking facilities. This is the fifth year the Byllesby properties have maintained free electric service for indigent invalids. In many cases temporary service connections and interior wiring have been installed without charge.

How the Fixture-Display Problem Was Solved at Keokuk, Ia.

In arranging the contents of an electrical store it is common practice for dealers to hang samples of lighting fixtures in rear rooms which may be at least partially darkened, so that the ornamented shades when illuminated may be displayed advantageously. For showing fixtures at their full beauty this plan undoubtedly has merit, but it possesses a disadvantage in that fixtures are seldom visible to the chance caller at the

FIG. 1—A SHOW WINDOW FOR DISPLAYING FIXTURES WHICH CAN BE SEEN FROM THE PAVEMENT

store unless he is conducted into the fixture-display room. Nor are the fixtures visible to the window shopper, who is a prospective buyer not to be overlooked.

To combine the good features of both a permanently visible display and a display in a closed room, Mr. C. S. Abell, of Keokuk, Ia., has arranged his store in the unusual and attractive manner illustrated in the accompanying photographs. Fig. 1 is the view which faces the visitor as he enters the door of the store. Practically the same view is obtained by every window shopper who gazes through the big plate-glass windows at the sidewalk line. Fig. 2 shows the interior of the

FIG. 2—INTERIOR OF CONTRACTOR'S SALESROOM AT KEOKUK

display room, with fixtures neatly arranged along the ceiling and walls, and with wired tables and shelves for showing small electrical appliances.

Making the Placard Sign Distinctive

At conventions of electrical associations where manufacturers' agents are exhibiting goods in hotel rooms printed placards are as a rule tacked over the room doors or hung on strings across the hallway in front of the doors. Sign painters may try conscientiously to make all of these cards attractive and different, but on the whole they all look much alike to the newcomer glancing down a hall filled with signs. One lamp salesman at a recent convention brought his sign out of the "common appearing" class by placing a large lamp in a reflector over the transom in his room, so that the lamp's rays were all directed against the sign. What the salesman did was not new nor did it require much work, but it made his sign distinctive among a great many similar signs and suggests how often this simple device could be profitably utilized by the department store and, in fact, wherever card signs are on display.

Central Stations Should Use Envelope Stuffers

Mr. George Williams, general sales manager for the properties of H. L. Doherty & Company, in speaking before a meeting of central-station salesmen in Ohio recently, said that any company which sends letters to its customers without inclosing some electrical manufacturer's advertising folder is losing a valuable advertising opportunity. All of the Doherty companies, he said, have special cabinets in which stocks of manufacturers' envelope stuffers are kept. Such a cabinet keeps the stock clean and prevents waste.

The only word of criticism which Mr. Williams had to offer was that the electrical manufacturer's name is sometimes displayed too prominently on and in the booklets. Less lavish use of the firm name, contended the speaker, would be in better taste and would create a more favorable impression in the mind of the recipient.

Electric Vehicles

Operating Experience with Electric Pole Trucks at Philadelphia

The 6-ton, four-motor-drive electric truck put into service by the Philadelphia (Pa.) Electric Company March 21, 1913, had covered up to May 1, 1915, 17,948 miles. It has averaged 30 miles per day in service, the maximum daily mileage being 53. During the two years it has taken 33,845 kw-hr. of energy, or 1.88 kw-hr. per mile. As testimony to the efficiency, economy and excellent performance of this electric pole truck, a second truck which is practically a duplicate of the first

PHILADELPHIA ELECTRIC COMPANY'S NEW POLE TRUCK

was purchased on March 18, 1915. The original battery in the first truck was of the twenty-one-plate type, but when the time came for renewal a twenty-three-plate type was installed. The batteries in both of the trucks have forty-four cells, and it is claimed that they are the largest electric-vehicle batteries in use in the State of Pennsylvania. The acquisition of this second truck will enable the company to eliminate to a great degree the use of horses for hauling poles.

The company's force recently hauled five heavy 45-ft. poles from the pole yard, Seventeenth Street and Sedgley Avenue, to Newton Square, Pa., for the Bell Telephone Company. While there is nothing significant in a 26-mile run, it is interesting to note that the distance was covered in six and three-quarter hours with a current consumption of 305 amp-hr. The poles hauled in this instance were above the average size, the entire load weighing approximately 8 tons. The great weight and the hilly condition of the country traveled caused the truck at times to consume three times more energy than under normal conditions.

The cost of this trip was $10.12, or $1.50 per hour, or slightly under 5 cents per ton-mile. Formerly this work required a four-horse team twenty hours, at $1.20 per hour, or $24. Thus the cost by electric vehicle represented a saving of approximately 40 per cent over the cost of haulage using horses.

The advantages to be derived by the use of electric trucks for pole hauling, as compared with the use of horses, are set forth by the superintendent of the company's transportation department as follows:

(1) The saving of time to and from jobs, which is important.

(2) More economy, because more work can be done in less time.

(3) Accidents are less likely, because the electric truck occupies less space on the street, because the driver has better control over it, and because it can turn corners with perfect safety, which is impossible with a four-horse pole truck.

(4) Loading and unloading can be done with less labor and with perfect safety by using the motor and winch.

The new truck is shown in the accompanying illustration. It differs from the old truck only in the steering device for the rear wheels, which is similar to that now used on hook-and-ladder fire trucks to facilitate the rounding of corners.

Electric Trucks in Railroad Freight Houses

Battery-driven industrial trucks are increasing in favor for handling goods in both transfer houses and freight houses, according to the report of the committee on yards and terminals of the American Railway Engineering Association, presented at the Chicago meeting of the association a short time ago. Many railroad officials have found the electric truck particularly useful when used as a locomotive for drawing a number of trailer trucks.

One railroad, which has fifty electric trucks in transfer service at its dock terminals, notes an operating cost

TABLE I—COMPARATIVE COST OF ELECTRIC-TRUCK OPERATION

	Tons Handled by Electric Trucks	Electric Trucks (Cents per Ton)	Hand Trucks (Cents per Ton)
Eastbound:			
Vessel to dock	24,050	19.12	29.23
Dock to car	12,383	11.38	13.15
Total	.....	30.50	42.38
Westbound:			
Car to vessel	2,452	21.15	30.30

of $8.74 per truck per month, including energy at 3.3 cents per kw-hr. In comparison with hand trucks, the cost of electric-truck operation was as shown in Table I.

TABLE II—AVERAGE RESULTS OF OPERATION

	Average per Month
Maintenance and repairs, including labor and material	$480.71
Cost of energy	487.99
Labor expense, including foremen, checkers, truck operators, freight handlers, sealers and coopers	5,496.58
Interest on investment and depreciation of property	778.13
Total average expense per month	$7,243.41
Average number of tons handled per month	17,010
Average cost per ton, cents	42.58
Average number of trucks in use per month	47

Later these trucks were put in service at a transfer station. The average results, based on seven months' operation (February to August, 1914) are given in Table II.

Akron's Economical 12-Ton Electric Ladder Truck

The 12-ton aerial ladder truck shown in the accompanying illustration has been in the service of the Akron (Ohio) fire department since June, 1914, and, according to Chief John T. Mertz of the department, its cost of maintenance has never exceeded $4.50 per month. Akron is a comparatively hilly city and possesses one particularly difficult incline—North Hill, which is half a mile long and has a grade of 13 per cent. The truck has made the run up this hill at a sustained speed of 12 miles per hour. Its speed on level pavement is 27 miles per hour. The wheelbase distance is 28 ft., and the height of the ladder, fully raised, is 86 ft. The ladder can be raised by an electric motor operated from the truck batteries, by the power of

heavy springs coiled in steel cylinders, or by hand in case the preceding methods should fail. Energy to operate this 12-ton Boyd truck is furnished by a storage

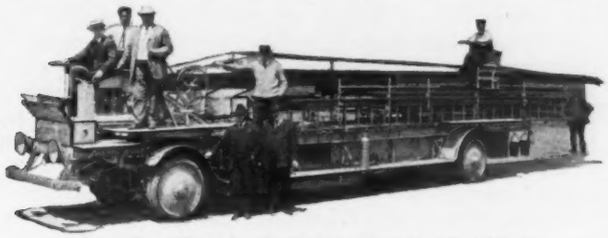


FIG. 1—12-TON ELECTRIC TRUCK AT AKRON

battery of eighty nineteen-plate cells, and the "Couple-Gear" wheels are equipped with Goodrich tires.

The Akron department has fifteen pieces of motor-driven fire apparatus, and Chief Mertz declares that with this equipment the city is far more effectively

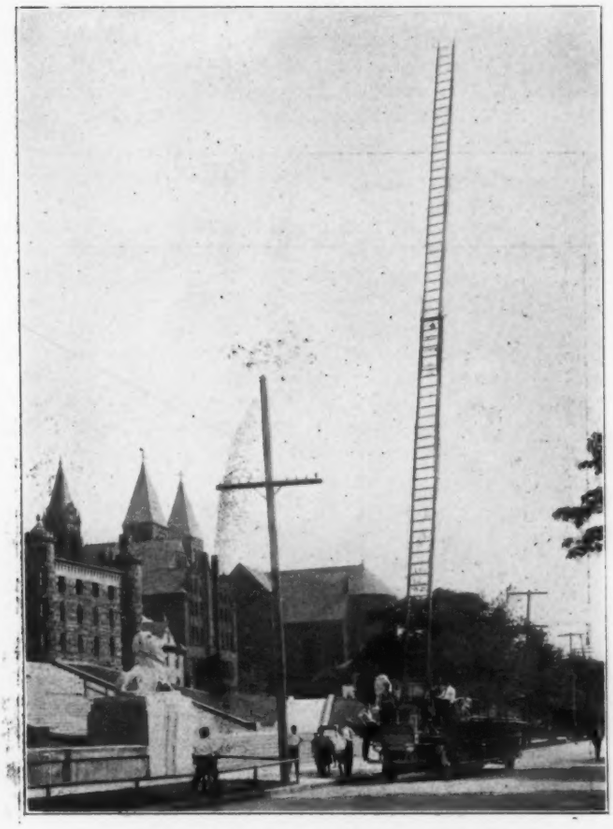


FIG. 2—TRUCK WITH LADDER ELEVATED

protected with eight fire stations than would be possible with horse-drawn equipment at twelve stations. Moreover, the cost of maintaining the motor-driven apparatus is much less.

A "Snowstorm" in a Show Window

An attractive window display of the made-to-order "snowstorm" variety, exhibited by the James Clark, Jr., Electric Company, Louisville, Ky., brought publicity to the store during an early spring hot wave which visited the Kentucky metropolis. Fans were so placed on brackets and on the floor of the inclosed show window that cross currents of air were formed when all the fans were in operation, and white confetti placed in the window in liberal quantity was constantly agitated and blown about in blizzard-like fashion.

Interior Construction

A Method of Breaking Off Tubes

BY ANTHONY GORMAN

It is frequently necessary for a wireman to shorten or cut off a porcelain tube. A porcelain tube should not (for pressures of 220 volts and lower) extend further than ½ in. beyond the timber or member through which it passes, because if it extends further the projecting portion is likely to be broken. Unless

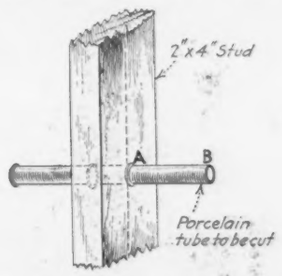


FIG. 1—ARRANGEMENT FOR BREAKING OFF PORCELAIN TUBES

the wireman knows exactly how to proceed in cutting off a porcelain tube, he is likely to spoil the whole tube in the attempt, but by the method indicated below he can, with a little practice, cut off a tube to the exact length required.

The process is indicated in Fig. 1. The wireman bores through some convenient timber a hole of a diameter slightly greater than the external diameter of the tube. The tube to be cut is then marked with a pencil line, as shown in Fig. 2, at the point at which it is to be cut. The tube is now pushed through the hole in the timber until the pencil mark on the tube is in line with the face of the stud, as at *A*, Fig. 1. Then striking the projecting end, *B*, of the tube a smart blow with one's hand will cause the tube, if proper precautions have been taken, to break off squarely at the pencil mark. The hole bored through the timber should be of such a diameter that the tube fits it snugly, otherwise the break may not occur at the pencil mark and the entire tube may be fractured.

If a tube has been cut by the method illustrated in Fig. 1, and it is found that it is ¼ in. or ⅜ in. too long, it may be shortened by pinching the porcelain wall with the pliers as illustrated in Fig. 2. By this process

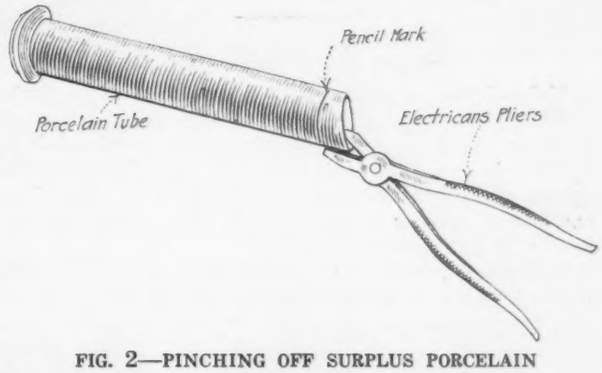


FIG. 2—PINCHING OFF SURPLUS PORCELAIN

the porcelain at the end of the tube is "crushed off" as far back as the pencil mark. In crushing off the porcelain a bite is taken with the plier jaws at one point, and the porcelain there is crushed. Then the tube is rotated and a new bite is taken, and this procedure is repeated until the tube has been bitten off around its entire circumference.

Baggage-Room Lighting in Kansas City Station

Simple construction, embodying, however, careful illuminating engineering design, characterizes the lighting of the great baggage room of the new Kansas City (Mo.) Union Terminal Station. The absence of natural light in the average baggage room demands that the room be well illuminated artificially. It must, moreover, be lighted in such a way that the maximum

BAGGAGE ROOM LIGHTED BY 250-WATT LAMPS

light flux falls on a plane near the floor, in order to insure speed and correctness in reading check numbers and addresses on baggage. Little or no account can be given to reflected light from the walls. The system employed at Kansas City consists of equally spaced 250-watt tungsten lamps with steel reflectors, the interior reflecting surface being of white enamel. How well the installation suits the purpose for which it was designed can be seen in the accompanying illustration, wherein the chalked word "Wabash" can be distinctly read on the post to the right.

Wiring the Humbler Homes

"Would you pay five cents a month to have electric light in your house?" This rental proposition, and another offering a complete wiring installation for $30 payable in ten monthly instalments, the Worcester Suburban Electric Company, Uxbridge, Mass., has found capable of solving its problem of connecting mill tenements in its territory.

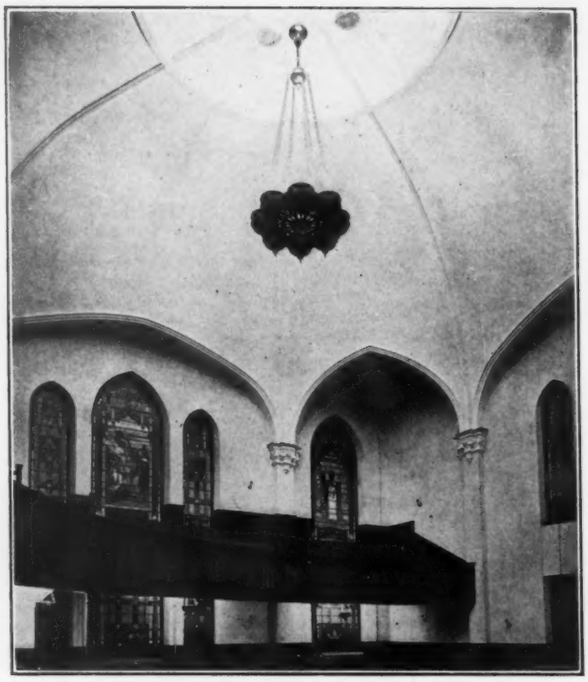
This company serves eight towns the total population of which is about 32,000. Six of the towns are mill towns, and more than 50 per cent of the houses in the territory are mill tenements which have heretofore proved very difficult to land. Occasionally the company was able to induce a mill owner to wire a group of houses, but its efforts and the results obtained were very spasmodic.

In order to obtain this undeveloped business, the company advertised that it would furnish to the owner of any property a complete installation of wires, fixtures and lamps for the sum of $30, payable in ten monthly instalments. It also offered to furnish to a tenant having the consent of the property owner two drop lamps, one in each of two adjoining rooms, with shades and carbon lamps, at a rental of 5 cents a month, the amount being added to the tenant's monthly bill for electrical energy. In the latter offer wiring is only done in cases when at least six houses in a given locality desire such wiring, and in such cases all wiring is exposed. This type of installation is offered to the tenant, but the owner or tenant may purchase the installation at any time for $7, no rentals paid being applied against the purchase price.

During the year 1914 about 400 old houses in the company's territory were wired, approximately 200 being obtained by the company's thirty-dollar proposition.

Indirect Lighting of Philadelphia Church

A simple and pleasing form of indirect lighting, which produces an average intensity of 2.5 ft.-candles in the room, is in service in the Trinity Reformed Church, at the northeast corner of Broad and Venango Streets, Philadelphia, Pa. From the center of the high-vaulted roof is suspended a crown-like fixture containing eight 400-watt tungsten lamps in reflectors. Under



TRINITY REFORMED CHURCH, PHILADELPHIA

the balcony at the rear of the church hang six bowl-fixtures, each containing four 60-watt tungsten lamps. The combined rating of the lamps amounts to 4640 watts.

The Variability of Inspection Charges

Mr. William S. Boyd, secretary of the Western Association of Electrical Inspectors, has compiled the schedules of inspection charges made by various communities and inspection departments, and finds the following range of prices on average-size lighting and motor installations:

	Lowest	Highest
Five-lamp installation	$0.50 to	$1.75
Ten-lamp installation	0.50 to	2.00
Fifteen-lamp installation	0.50 to	2.25
1-hp motor installation	0.50 to	2.05
3-hp motor installation	1.00 to	2.50
15-hp motor installation	1.50 to	6.75

Lighting Practice

Three "White-Way" Installations in Ohio

The development of the art of street lighting has been extremely rapid, one of the latest advances being the use of large candle-power units for ornamental standard lighting.

The "white-way" system at Painesville, Ohio, when put into service was one of the very first to employ the nitrogen-filled lamp. Fig. 1 gives a good idea of the results obtained. The lamps are rated at 600 cp and

FIG. 1—"WHITE WAY" LIGHTING AT PAINESVILLE, OHIO

are placed in ornamental standards about 65 ft. apart, the lamps being about 12.5 ft. above the sidewalk.

All wiring is in underground conduit, and the system is controlled by two Packard regulators. At the same time that the "white way" was installed the entire installation of arc lamps for general street lighting was superseded by nitrogen-filled tungsten series lamps of sizes ranging from 600 cp downward. These units, where of 250 cp or above, were substituted for suspended arc lamps, with no protection from weather other than the same reflector used with the arc lamps. Up to the present time the only lamps which had to be replaced were broken by accident, no lamps having burned out or been broken from weather conditions.

FIG. 2—MAGNETITE SYSTEM AT AKRON, OHIO

FIG. 3—THE AKRON SYSTEM AFTER DARK

For the sake of comparison the Akron "white way" is shown both by day and by night. It will be noted that all wooden poles had been removed from the streets, and the appearance of the district was very much improved thereby. The Akron "white way" employs magnetite-arc lamps, spaced about 75 ft. apart.

The Barberton "white way" represents a different condition from either of the two systems already referred to. There, in order to get rid of all other poles on the streets, the trolley poles run up through two-

FIG. 4—BARBERTON'S TWO-LAMP AND THREE-LAMP STANDARDS

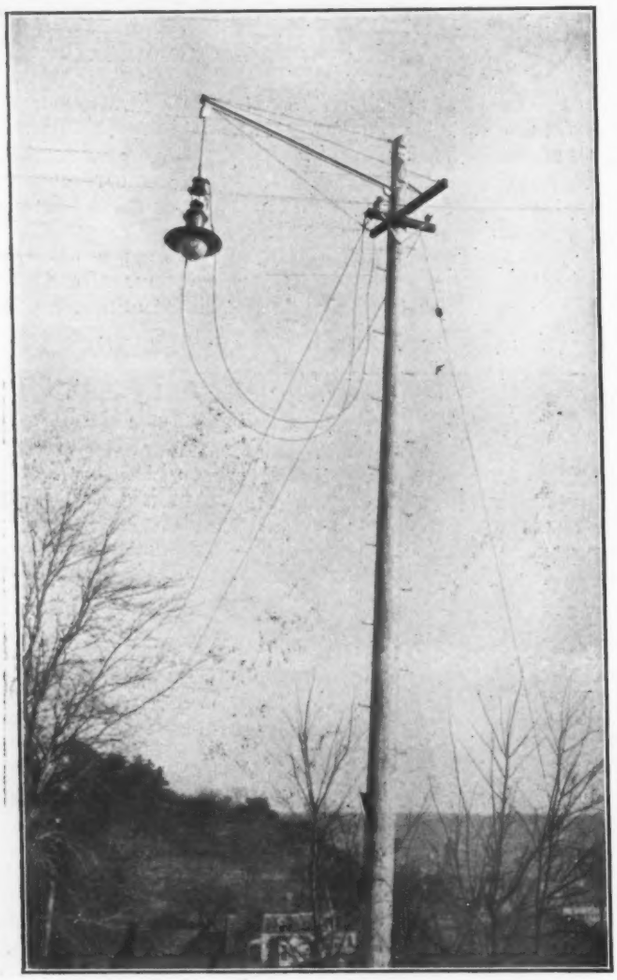
lamp ornamental standards. The poles are spaced about 110 ft. apart, and between poles are three-lamp standards of the same design. The two side lamps are rated at 100 watts while the top lamps are rated at 40 watts. The systems were designed and their installation supervised by H. Whitford Jones & Company, consulting engineers, Cleveland, Ohio.

Gas-Filled Lamps Showing Remarkable Longevity at Dubuque, Ia.

In the summer of 1914 the streets of Dubuque, Ia., were being lighted by 475 6.6-amp General Electric arc lamps. Although these units had been in operation for eleven years, they were still giving good service. Energy was supplied to these arc lamps through a bank of constant-current transformers which at normal rating could serve 500 lamps.

With this condition existing, the city ordered the Union Electric Company, from which it was purchasing street lighting, to install 141 additional lamps, and

as Mr. E. M. Walker, general manager of the central-station company, tersely said: "It was a case of either spending $5,000 for rebuilding arc-lighting circuits and purchasing new transformers, or spending $7,000 for changing to a new and modern system. We chose the latter." Hence Dubuque, Ia., and East Dubuque, Ill., are now illuminated with gas-filled tungsten lamps. In East Dubuque there are thirty-four 400-cp, 15-amp units, and in Dubuque there are 585 600-cp, 20-amp units. All of these 619 lamps are operated from the same circuits and through the same six constant-current tubs which formerly served the 475 arc lamps. The energy consumption per lamp in the new installation is about 75 per cent of what it was with the arc lamps. The power-



STREET LAMP WITH COMPENSATOR IN HOOD

factor of the street-lighting load has been increased from about 70 per cent to about 90 per cent, so that in reality about 900 of the new lamps could be operated from this system without the purchase of additional equipment. About 50 per cent more light per lamp is said to be obtained from the new system than from the old one, and the illumination is steadier.

The gas-filled lamps were installed in August and September and since that time have been operated on an all-night, every-night schedule. Most of the original lamps are still operating, so that definite life figures cannot be given. But it is estimated that 10 per cent of the bulbs have been renewed and that the remainder have been operated more than 2000 hours.

According to the system of charging for street lighting in Dubuque, the company rebates the city for all lamp outages observed by the police. The city electrician keeps a record of the number and duration of observed outages and at the end of the month deducts the total rebate from the bill presented. Since the new system has been in operation the amount of these deductions has been materially decreased in spite of the fact that all lamp renewals are now made by the night trouble-man, while formerly the services of one man with a horse and wagon were required to trim the arc lamps. The illustration herewith shows one of the new lamps installed on a 300-ft. bluff which towers above the business section of the city.

"Sensation-White" and Color-Matching White Light

For purposes of color matching, "white light" is such a light that colors which appear the same in daylight will also appear the same under the artificial white light, whatever dyes are used. The distinction between color-matching white light and "sensation-white" light was explained by Dr. Henry Phelps Gage, Corning, N. Y., before a recent meeting of the New England Section of the Illuminating Engineering Society.

There are several colors which appear the same under one kind of daylight, such as that from a cloudy sky, and yet differ appreciably when viewed under another kind of daylight, such as that from the sun or from the blue sky. Such colors, as might be expected, appear vastly different under ordinary artificial light. Color-matching white light may or may not appear exactly the same as daylight, but the real criterion is the test of like-appearing colors produced with different dyes.

Contrasted with this is the "sensation white," which appears exactly the same as daylight, but which the spectroscope reveals is made up of a discontinuous or partially discontinuous spectrum. Although the three sensations, red, green and blue, may be in just the proportions to give white, this resultant will not be good for matching colors. On the other hand, a good color-matching white will probably be a good sensation white also.

In seeking correct media a glass is desirable which absorbs no violet. There are only a few oxides of metal which when dissolved in glass will produce the necessary colors. The kind of glass used also affects the resultant color. Sodium glass is less suitable than potash glass for proper absorption. The greatest difficulties come in dealing with browns. Different elements are combined variously in studying the absorption of different glasses. Nickel always gives the same color in the same kind of glass, but its use is patented.

DATA ON COLOR CORRECTION

Character of Daylight	Lamp Efficiency, per Cent	
	0.5 Watt per Cp.	0.65 Watt per Cp.
Sunlight on magnesium oxide....	116	100
Overcast sky.....	82	66
Blue sky, hazy.....	34	31
Blue sky, clear.....	29	24

The accompanying table shows the depth of color of roundels of one melt of glass to correct the color of a nitrogen-filled tungsten lamp to the color of different kinds of daylight. The 100 per cent roundel listed in the table transmits approximately 20 per cent of the incident white light.

Such color screens are useful in the dye rooms of textile mills and elsewhere. An intensity of about 35 ft.-candles is the minimum desirable over a small area.

NEW APPARATUS AND APPLIANCES

Small Portable Electric Oven

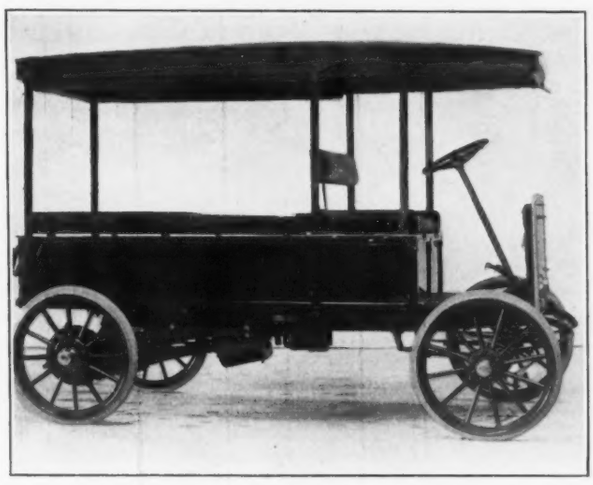
In the accompanying illustration is shown a small oven developed by the Hotpoint Electric Heating Company, Ontario, Cal., for use with its electrically operated "El Glostovo" and "El Grilstovo," both of which are of the glowing-coil reflector type. The device is called

OVEN FOR USE WITH STOVES OF GLOWING-COIL TYPE

an "ovenette," and is of seamless sheet steel finished in nickel. It is being made in three sections as shown, which make it adaptable to two sizes.

Light Electric Delivery Truck

In the accompanying illustration is shown a light delivery truck, with an open flare-board body and six-post top, which has been built for use by the sales department of the Benton Harbor-St. Joe (Mich.) Railway & Light Company. The truck weighs 2100 lb. and has a wheel base of 90 in. A General Electric motor and a drum-type controller are employed to operate the vehicle. A worm-drive axle is utilized, the worm having been made by the Bausch Machine & Tool Company, Springfield, Mass. The truck is equipped with a twenty-cell Philadelphia battery. The car operates at speeds varying from 8 miles to 14 miles an hour and



2100-LB. ELECTRIC TRUCK

will run from 40 miles to 50 miles on one charge. Cantilever springs are provided in the rear and semi-elliptic springs in the front of the truck. The truck is designed to carry a 750-lb. load exclusive of driver and helper. It was made by the Milburn Wagon Company, Toledo, Ohio.

Bell-Ringing Transformer

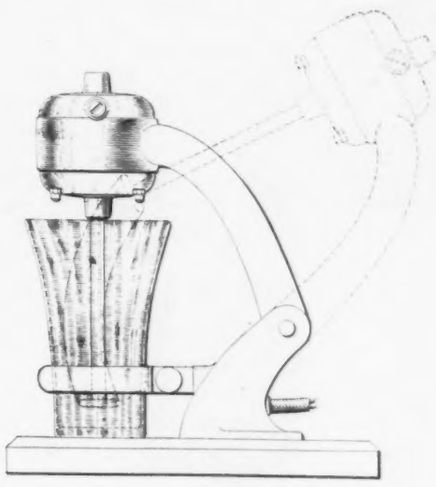
A small transformer designed for changing 110-volt, sixty-cycle alternating current to pressures of 4 volts, 8 volts and 12 volts is being made by the Pittsburgh Transformer Company, Pittsburgh, Pa. The trans-

BELL TRANSFORMER WITH PROVISION FOR THREE SECONDARY VOLTAGES

former is mounted in a metal case which is finished in black. According to the manufacturer, the device will not burn out or heat up appreciably even if the low-voltage wires become short-circuited. The device weighs 3.5 lb. and measures 6 in. by 3.5 in. by 2 in. With a slate base the weight is 6 lb., and the dimensions are 7 in. by 5 in. by 2.75 in. On account of the three secondary voltages the transformer is particularly well adapted for use with bells designed for operation at different pressures.

Electric Drink Mixer

The motor-driven drink mixer shown in the accompanying diagram is mounted on a swing bracket. When the machine is pushed back and removed from the glass it takes the position indicated by the dotted lines in the diagram. The operation also causes a switch in the



ELECTRIC DRINK-MIXING MACHINE WITH SWING BRACKET

bracket to act and open the circuit. By swinging the bracket down again the circuit is closed. The device is heavily nickel-plated and is mounted on an onyx base. The mixer is 8 in. high and takes 24 watts. It is being made by the Shelton Electric Company, Forty-second Street Building, New York.

Combination Vacuum Cleaner and Carpet Sweeper

An outfit consisting of an ordinary carpet sweeper on which is mounted a vacuum cleaner is shown herewith. The nozzle of the vacuum cleaner is directly in front of the sweeper. The carpet sweeper is used for gathering lint, threads, etc. The apparatus is so designed that the cleaner and sweeper can be used separately if desired, an extra handle being provided for the carpet sweeper for such operation. The weight of the vacuum cleaner is 9.5 lb. and that of the sweeper 3 lb. The outfit stands 8⅛ in. high. The case is of pressed steel and is finished in nickel. Use is made of a 12-in. nozzle, which is provided with an adjusting device for height and with an eight-blade fan. The motor is supported above the sweeper in a horizontal position. Hose connection is made to the machine for cleaning draperies, curtains, etc., by pushing aside the sliding cap at the front of the machine and attaching the hose-connecting device. The combined sweeper and vacuum cleaner is being placed on the market by the Pneuvac Company, Boston, Mass.

COMBINED CARPET SWEEPER AND ELECTRIC VACUUM CLEANER

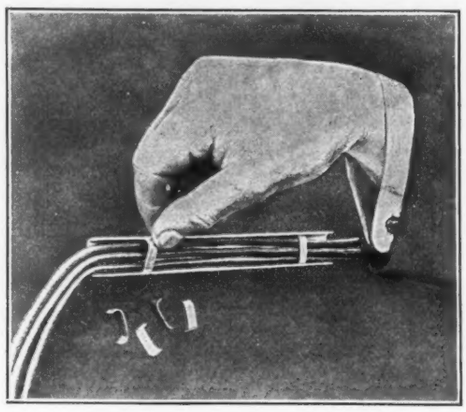
Switch for Panelboards

A small snap switch for mounting on panelboards has recently been placed on the market by the Arrow Electric Company, Hartford, Conn. It is designed to take a composition cover as shown herewith, the outside dimensions of which are 1 29/32 in. by 2 9/32 in. by 1⅝ in. The cover is colored black to match the board. The switch may be equipped with either a round or a wing handle as desired. The outside dimensions of the porcelain base are 1⅝ in. by 2 in. The height over all of the base is 1 5/64 in. Four screw holes are provided in the base which are spaced on 1⅝-in. centers diagonally and on 1.5-in. centers horizontally. The base is designed to allow a minimum spacing of ⅞ in. between branch busbars. The bridge wall separating the busbar terminals is ⅛ in. wide.

PANELBOARD SWITCH

Holder for Wires in Metal Molding

A small spring-steel fitting designed to fit inside the base of metal molding, into which it snaps with very slight pressure, and to hold the wires (either two or three, as the case may be) in position, is being made by Edwards & Company, 140th and Exterior Streets, New York. With such a fitting both hands of the workman are left free to apply the capping to the base. The holder is so small that it may be left inside the molding when the capping is put on without interfering in any way, it is declared, with the wires. The device is particularly well adapted for ceiling and side-wall runs. By use of the wire holder a job can be completely wired, the manufacturer points out, before the capping is placed in position.



WIRE HOLDERS FOR METAL MOLDING

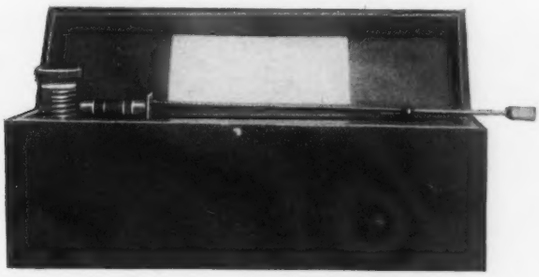
Oscillating Fan

An 8-in. oscillating fan which will operate on both direct current and twenty-five-cycle, thirty-cycle, forty-cycle or sixty-cycle alternating current is shown in the accompanying illustration. The oscillating mechanism consists of a double worm-gear running in grease and entirely inclosed in the gear case at the back of the fan. A knurled screw is provided to change the range of oscillation. The fan is being placed on the market by the Carleton Company, 170 Summer Street, Boston, Mass.

OSCILLATING FAN OF 8-IN. DIAMETER

Fuse Tester

Apparatus for testing plug and cartridge fuses of all types and sizes is being placed on the market by Bremer & Lang, 59 Hancock Avenue, Jersey City, N. J. The instrument is provided with a buzzer, and if the fuse is



FUSE-TESTING INSTRUMENT

in good condition the buzzer will operate. The device is particularly well adapted for determining whether a fuse has blown or not.

Fixtures for High-Efficiency Incandescent Lamps

Several types of reflector units with interchangeable parts have been developed by the Electric Devices Company, Leader Building, Cleveland, Ohio, for use with nitrogen-filled tungsten lamps. Each unit is equipped

FIG. 1—HOLDER FOR GLASS GLOBES

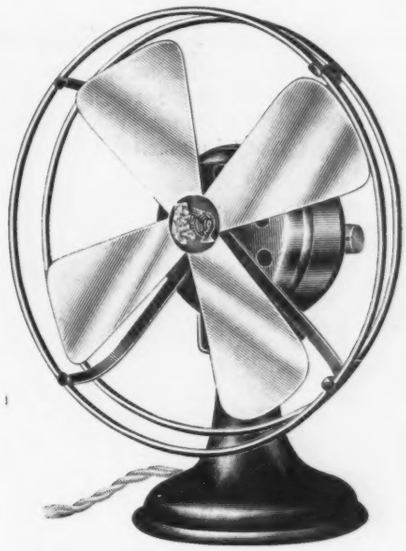
with a device for adjusting lamps of different sizes in their proper positions in relation to the reflectors. The fixtures are designed for lamps varying in rating from 100 watts to 1000 watts. The complete units include, besides the reflector and adjusting device, a socket, a

FIG. 2—DOME REFLECTOR, WITH SOCKET HOLDER

socket holder, a ventilating cap, a nipple for 0.5-in. iron pipe, and a glassware holder. The holder is equipped with a latch with which allowance can be made for variation in the size of the glass globes and by means of which a loose or tight fit can be obtained as desired.

Electric Desk Fan

The electrically operated fan shown herewith can be moved through a vertical arc of approximately 90 deg. and may be turned completely around on its base so that the breeze can be thrown in any direction desired.



ELECTRICALLY OPERATED DESK FAN

It operates on either direct current or alternating current at 105 volts to 115 volts. Use is made of noiseless bearings, and these, according to the manufacturer, do not require oiling. The fan measures 8 in. high, 7 in. wide and 4 in. deep. The guards, brushholders and fan blades are finished in nickel. The other parts of the fan are finished in velvet black. The base is of cast iron. The total weight of this fan, which is being made by the Mysto Manufacturing Company, New Haven, Conn., is 2 lb. 6 oz.

Automatic Door Switch

In the accompanying illustration is shown an automatic door switch designed to be installed flush with

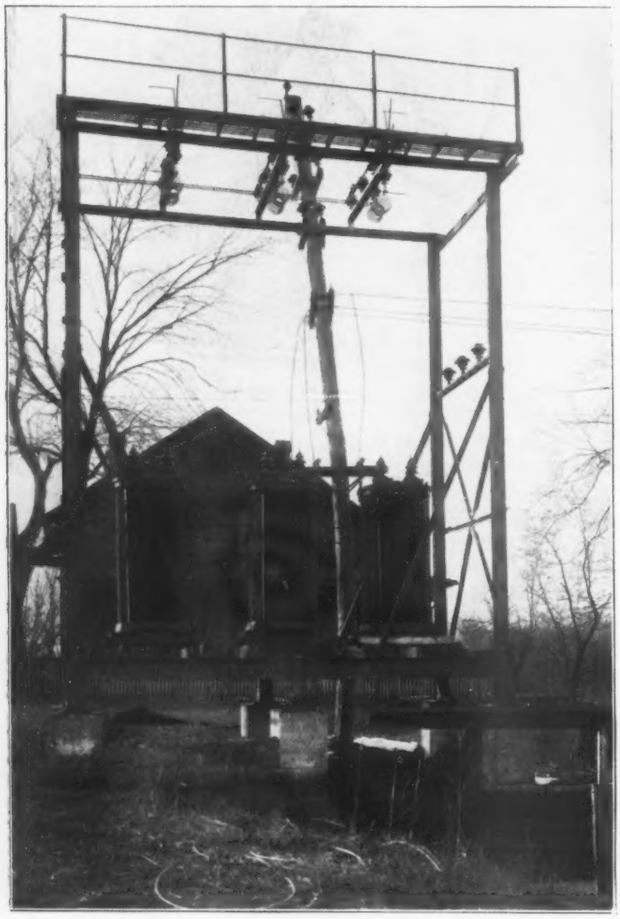
AUTOMATIC DOOR SWITCH

the door jamb for controlling lamps in cellars, closets, refrigerators and other places where lamps are likely to be forgotten and left burning when not required. The switch is being made in two forms, the mechanism of one being designed so that the circuit is closed when the door is opened and the other so that the circuit is

closed when the door is closed. Both forms are of the single-pole type and are rated at 3 amp at 250 volts and 6 amp at 125 volts. The switches are being manufactured by the General Electric Company, Schenectady, N. Y.

Self-Contained Steel-Tower Substation

In the accompanying illustration is shown an outdoor steel-tower substation of large rating, manufactured by the Delta-Star Electric Company, 617 West Jackson Boulevard, Chicago, Ill. The substation is entirely self-



SELF-CONTAINED STEEL-TOWER OUTDOOR HIGH-TENSION SUBSTATION

contained and is so designed that as the demand for energy increases larger transformers can be installed without the necessity of any change except substituting fuses of larger ratings. By means of suitable steps and top-platform racks, the manufacturer points out that a lineman can easily, safely and quickly inspect the equipment, make adjustments, etc.

Electric Nail-Packing Machine

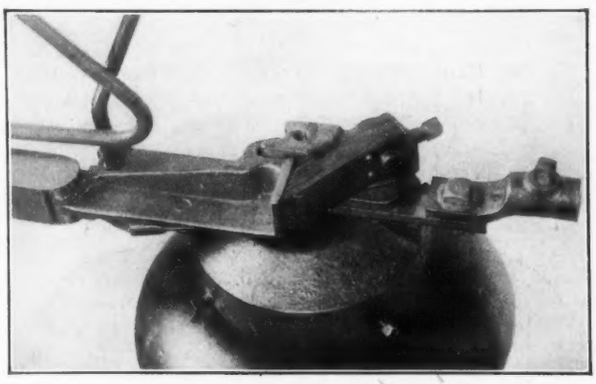
A machine which is designed to pack nails and similar iron products in parallel by means of electromagnetic force is being placed on the market in this country for the manufacturer, Otto Gamper, Zurich, Switzerland, by Albert T. Otto & Sons, Inc., 1876 Broadway, New York. The operation of the machine is based on the principle that linear iron objects when brought into a magnetic field will automatically take a position parallel to the lines of force. The machine consists essentially of the paralleling mechanism, a feeding trough and a shaking device. By means of the last named the nails glide gradually into the paralleling mechanism and while still falling are drawn in the direction of the lines of force. The nails are pressed into a tray fixed between the two magnet poles by a lever which also shuts

MACHINE FOR PACKING NAILS IN PARALLEL

off the energy supply. The tray swings downward and by a slight jerk the nails can be emptied into paper cartons. By shifting the front magnet pole and inserting a packing tray to correspond with the length, nails of any size can be arranged in parallel and packed. A 0.5-hp motor is employed to operate the shaking device. The paralleling mechanism operates on direct current at 110 volts or 220 volts and consumes 1.5 kw-hr. a day. The machine is 5 ft. high and occupies a space 6 ft. 8 in. by 4 ft. 4 in. It weighs 1300 lb.

Brush Contact for Horn-Gap Switch

A copper-leaf brush contact has been developed by the Railway & Industrial Engineering Company, Pittsburgh, Pa., for use with the Burke horn-gap switch. The contact is covered with a steel hood, which is removed in the accompanying illustration. It is protected from all burning, it is declared, by auxiliary arcing horns. The switch arm is jointed, and the short-end section against which contact is made is normally held at an angle by a spring inclosed in a square brass hous-



HORN-GAP SWITCH WITH COPPER-LEAF CONTACT

ing. In closing the switch, the arm meets the stationary block which supports the laminated brush and lateral motion is obviated. A hook is provided on the end of the arm so that the arm can be brought to an angular position when the switch is opened without depending upon the spring.

CURRENT NEWS SECTION

Public Service Commissions in New York Constitution

At a hearing on June 23 before the public utilities committee of the New York State Constitutional Convention, now in session at Albany, representatives of public utility companies urged that the Public Service Commissions be made constitutional bodies. Mr. J. C. De Long, Syracuse, N. Y., president of the Empire State Gas & Electric Association, spoke on behalf of that organization. Mr. F. D. Corey appeared for the Niagara, Lockport & Ontario Power Company. Mr. John L. Swayze represented the New York Telephone Company. All spoke in favor of making the commissions constitutional bodies with some restrictions upon the Legislature as to rates and court review.

Mr. De Long said that there had been a great change in the attitude of public service companies. Ten years ago probably 80 per cent of the gas and electric companies were afraid of regulation, while now a larger percentage of them are in favor of it, and to such an extent that they want to have the commissions made constitutional bodies and thus become permanent institutions for at least twenty years. He thought that the commissions should have exclusive jurisdiction over rates, regulation, service, equipment and operation, but that their decisions should be subject to court review. He favored terms of ten years for members of the commission but thought that it was unimportant to provide that the commissions should be bi-partisan. Mr. Corey confined his remarks solely to the subject of court review.

Panama-Pacific Convention of the A. I. E. E.

The meetings and papers committee of the American Institute of Electrical Engineers has been actively engaged for some time in preparing the technical program for the Panama-Pacific convention, at San Francisco Sept. 16 to 18, 1915, and has tentatively accepted the following papers for the convention program:

"Submarine Telephony and Telegraphy," by Mr. Bela Gati; "Automatic Telephone System of Los Angeles," by Mr. W. Lee Campbell; "Transient Voltages," by Mr. F. W. Peek, Jr.; "Arc Phenomena," by Mr. Alfred G. Collis; "Experiences with Diesel Engines Driving Generators in Mine Work," by Mr. Charles Le Grand; "Electrically Driven Compressor Plants," by Mr. L. E. Alexander; "The North Butte Hoisting Plant," by Mr. Wilfred Sykes; "Central Stations for Mine Loads," by Mr. Martin H. Gerry; "Overhead Electrolysis and Strain Insulators," by Mr. S. L. Foster; "Standard Marine Installations," by Mr. H. A. Hornor; "Commutation," by Mr. B. G. Lamme; "Delta Cross-Connections in Polyphase Systems," by Mr. G. P. Roux; "Harmonics in Transformer Magnetizing Currents," by Mr. J. F. Peters; "Train Lighting," by Mr. R. C. Lanphier; "Experimental Researches on Skin Effect in Conductors," by Messrs. Kennelly, Laws and Pierce; "Abnormal Voltages in Transformers and Type of Winding Which Is Immune from Such Voltages," by Mr. J. Murray Weed; "Peak or Crest Voltmeters," by Dr. Clayton H. Sharp; "What Constitutes Working Capital," a symposium, collected by Mr. William B. Jackson.

There are also under consideration proposed joint sessions with the Institute of Radio Engineers and the American Electrochemical Society.

The annual A. I. E. E. convention will be held at Deer Park, Md., from June 29 to July 2.

Idaho Hydroelectric Merger Authorized

The merging of the five large hydroelectric companies occupying the southern Idaho field, the Idaho Power & Light Company, the Great Shoshone & Twin Falls Water Power Company, the Idaho Railway, Light & Power Company, the Southern Idaho Water Power Company and the Idaho-Oregon Light & Power Company, is a benefit to the territory which they occupy and should add to the financial interests of the State. This is the opinion of the Public Utilities Commission in a decision which follows investigation of the project. These five companies are to be merged into the National Securities Corporation, a temporary holding company. All the companies have been engaged in a rate war, resulting in great depreciation of their respective properties, with the result that four of them were in the hands of receivers. The National Securities Corporation decided that a merger would result in better service and bring the losses to an end.

The investigation was made by the commission as the result of a request from the Attorney-General, whom Governor Alexander had asked to ascertain if the law was being violated. The commission held two hearings. At the first Mr. G. M. Dahl, president of the National Securities Corporation and vice-president of the Electric Bond & Share Company of New York, testified that the merger was being perfected to prevent further heavy losses. A second hearing became necessary because Mr. C. L. Tallmadge of New York alleged that the merger was in violation of the law and would result in losses of thousands of dollars to small investors. He made his charges first in a telegram and later in a brief filed with the commission, but failed to appear in person. Mr. Allen Hollis of Concord, N. H., who represented some of the bondholders, appeared and supported Mr. Dahl's testimony. This concluded the hearings, and the commission's order followed. The decision says:

"It is obvious that the immediate effect of the proposed merger will be to give us but one large operating hydroelectric company in the territory where we now have five. There should follow immediately very large reductions in operating expenses. Further economies should follow from the linking of these systems and the resulting ability to use on one system the surplus power developed on another, and would make unnecessary for the present the further development of power units and the expenditures incident thereto.

"If our Legislature had not enacted the public utilities act of this State the formation of such a merger would inevitably endanger the rights of the patrons of these public utilities to be supplied with adequate and efficient service at reasonable cost.

"Under our public utilities act, with ample power in the commission to enforce adequate service and to regulate rates, none of these dangers need be apprehended. In the place of five separate companies struggling for

continued existence there will be one strong company enjoying, under the economies to be effected, a sufficient income to net a reasonable return upon its investment and able to serve the public with that degree of promptness, dependability and efficiency to which it is entitled. This service will be rendered under the supervision of the Public Utilities Commission, and no violation of the rights of the consuming public need be apprehended."

Trade with China and Brazil

The establishment of a series of foreign-trade correspondence centers at important American and Chinese cities and the founding of a commercial museum in China, where American materials and manufactured products could be on exhibition, are possibilities arising from the visit of the Honorary Commercial Commission of China now touring the country. The initiative has been taken by the Chinese. Vice-chairman Chi-Che-Nieh of the Chinese commission has suggested to Mr. John H. Fahey, president of the Chamber of Commerce of the United States, that the trade-opportunity correspondence be conducted by the Chinese Chamber of Commerce and the National Chamber here. Mr. Nieh was equally enthusiastic in presenting the idea of an American trade museum in China.

For the last year the chamber has interested itself in the matter of securing the reduction of tariffs maintained so high by South American countries on certain articles as to present a barrier to their export by American manufacturers. Complaints received from members have been presented to the State Department for transmission to the American diplomatic representatives in these countries. Mr. Edwin V. Morgan, American Ambassador to Brazil, has advised the State Department that the Minister of Finance in that country is about to appoint a special commission to study the subject of revision of the Brazilian tariff and report to the Brazilian Congress.

Delegates Return from Convention Tours

The "red special" train of delegates returning from the National Electric Light Association convention, held in San Francisco on June 7 to 11, reached New York at 6:20 p.m. on June 22. It was fifty minutes late in arrival at the end of the transcontinental journey, as the result of a landslide on the Minneapolis, St. Paul & Sault Ste. Marie Railway Company, which delayed it two hours before St. Paul was reached.

The special train left San Francisco at 8 p.m. on Saturday, June 12. The first stop was made at Shasta Springs, Cal., on the following morning. At this point a photograph, which is reproduced herewith, was taken by courtesy of the Wagner Electric Manufacturing Company. The party reached Portland, Ore., on the morning of June 14, and the visitors were entertained by officials of the Portland Railway, Light & Power Company. They traveled about the city in automobiles and special electric railway cars, and were shown many courtesies by a local reception committee. Leaving at noon on that day, the party went to Seattle and, although the time was short, officials of the Puget Sound Traction, Light & Power Company showed the visitors about the city and entertained them with many courtesies.

The trip to Vancouver was made on a steamer of the Canadian Pacific Railway Company. Upon the arrival of the steamer at Vancouver the delegates were met by officials of the British Columbia Electric Railway Company, Ltd. A dinner and dance given by officials of the company at the Vancouver Hotel were greatly enjoyed. Mr. George Kidd, general manager of the company, acted as official host representing the company and extended a warm welcome to the visitors. Mr. Holton H. Scott, retiring president of the association, responded on behalf of the delegates.

The travelers boarded their train again at Vancouver and then went through the Canadian Rocky Mountains, stopping at the principal points of interest. Several passengers left the train when it reached St. Paul and more stopped at Chicago. There were 138 people on the train during the return trip.

Special cars of convention delegates who returned to the East by way of Yellowstone National Park were due in New York at 5:28 p.m. on June 24.

Harvester Trust Case to Be Reopened

The United States Supreme Court has ordered the case of the International Harvester Company to be reopened for new argument at the fall term. The action of the court was a surprise, as neither the government nor the company attorneys requested it.

It is believed to be possible that reargument has been ordered because of the many questions in this case which have not arisen heretofore in the government prosecutions against industrial combinations and because many of these questions come within the purview of the Federal Trade Commission and Clayton acts. It has been inferred in Washington that members of the court are divided almost evenly on some of the questions involved, and that with a reargument there may be a possibility of a decision approaching unanimity.

The importance of this case has assumed increased proportions since the recent understanding that the Attorney-General has adopted the policy that future action by the Department of Justice shall be based on the result of the Supreme Court decision in the Harvester case. It is said that until this case is decided no important prosecutions of similar kind will be begun.

N. E. L. A. "RED SPECIAL" AT SHASTA SPRINGS, CAL., JUNE 13

Memorial Services for Dr. Pearson

Memorial services for Dr. and Mrs. Fred Stark Pearson, who lost their lives when the steamship *Lusitania* was sunk by a German submarine on May 7, were held at the Church of the Divine Paternity, New York, on June 23. At the hour of commencement of the services, 2 o'clock, the wheels of various central electric stations, electric railway and railroad companies with which Dr. Pearson was connected in Europe and North and South America were stopped for five minutes. Many friends and business associates of Dr. Pearson, including delegations from technical societies, were present. The services were conducted by Dr. Frank Oliver Hall, pastor of the church. Mr. E. W. Rice, Jr., president of the General Electric Company, and Prof. William L. Hooper of Tufts College paid tributes to the memory of Dr. and Mrs. Pearson.

Examination of Memphis Plant

The plant of the Merchants' Power Company, on which the city of Memphis, Tenn., has an option extending until July 1, in accordance with the terms of the franchise granted to the company in 1905, will be examined by an engineer from New York, who has been recommended by one of the public service commissions of that State. His name has not been announced by the Memphis authorities. The examination is to follow an earlier one made by Chicago engineers, who reported that much of the equipment was old, having been bought second-hand, and that with the $1,500,000 to be made available by the sale of bonds the city commission could do better by building an entirely new plant. This report, in the view of the commission, made a thorough examination advisable.

Mayor Crump said that the investigation would have to be pushed a little, as the commission must give its answer to the Merchants' company by July 1.

Protest Against Cincinnati Valuation

President W. W. Freeman of the Union Gas & Electric Company, Cincinnati, has sent a communication to the Public Utilities Commission of Ohio protesting against the tentative valuation of the electrical properties of the company promulgated by that body for rate-making purposes. President Freeman says in part:

"1. The commission has not valued certain items which must be included in any consideration of 'fair value for rate-making purposes,' particularly the 'cost of franchises' and the 'cost of financing.'

"2. While the company contends that there should be no deduction for 'accrued depreciation' in any valuation of its property for rate-making purposes, but that its rates should be at least sufficient to afford a return upon the entire value of its property now, the amount deducted by the commission in reaching 'present value,' as found in the order of the commission, is excessive and does not truly represent the 'lessening in value of the property on account of its lack of newness' irrespective of whether or not such an amount should be deducted for rate-making purposes.

"3. This company has filed its detailed valuation, giving its estimate of the real value of the property, and the value as tentatively found by the commission is unduly low. This is particularly true of the items 'land,' 'working capital' and 'cost of developing the business,' but such comparisons as have been made give evidence of additional undervaluations both in detail and in the aggregate.

"Therefore, the Union Gas & Electric Company hereby protests against the valuation as found in the order of the commission, dated June 3, 1915, and respectfully requests the commission, as required by law, to fix a time for the hearing of this protest and to consider at such hearing matter material thereto which this company desires to present in support of its protest."

The company sent two representatives to Columbus on the day preceding the dispatch of this communication to make an inspection of the data gathered by the commission's engineers. Their instructions were to search the data for such information as they may care to use in contesting the tentative commission valuation.

The Trade Commission and Foreign Competition

Chairman Joseph E. Davies of the Federal Trade Commission made an address on June 20 at the convention of the Associated Advertising Clubs of the World at Chicago. He discussed some of the acute questions before the commission.

There is no doubt, added Mr. Davies, that one of the essential purposes underlying the creation of the commission was also to provide an administrative agency to make more easy the accommodation of business to the requirements which government imposes for the benefit of society. It will be the purpose of the commission to translate this idea, which was so largely responsible for its creation, into its policy and attitude toward business and the public interest. The interest of the public, of complainants, and those complained against, all require that in the accommodation of business processes to government requirements readjustments shall be brought about as easily and with as much speed as is consistent with law and due regard for the rights of all. Business men to-day do not desire to disobey the law intentionally. A common understanding of the facts arrived at through full and frank conference of persons complained of with the commission may result frequently in the stopping of the alleged unfair practices more expeditiously than would lengthy legalistic procedure.

Chairman Davies declared that the purpose of the commission is not to harass, but to help—not to make a legalistic record, but to bring relief and aid, and to serve the public interest efficiently and bring "first aid" to the injured competitor before the patient is exhausted by long-drawn-out technicalities of legal action.

Dumping and Unfair Competition

Continuing, Mr. Davies said that the recent cutting off of the European supply in certain lines heretofore supplied from foreign markets has demonstrated the necessity of the creation of independent, self-sustained, permanent industries indigenous to our conditions for the production of such supplies. Such enterprise here is confronted with the possibility that unfair methods of competition will be employed by foreign monopolies subsequent to the war. Local price discrimination, whereby prices are lowered in one community for the sake of driving out competition, when at the same time prices are raised in another locality to recoup such loss where there is no competition, is prohibited as between residents of the United States. It is urged that the same degree of protection afforded American industry from such unfair competition from a local competitor should be afforded equally if the competition might come from a foreign source.

"Dumping" by foreign monopolies into this country either of their surplus products or of their competitive products, and the selling of such products at a cost in this country below the prevailing market cost in the country of production, is vicious in practice and holds potentialities of great harm to American industry and

to the American people. American enterprise and industry indigenous to our soil and native to our conditions are entitled to have such competition of foreign monopoly declared to be unfair and to have such practices prevented if an attempt is made to employ them.

Trade Bodies Oppose Government Ownership

As the result of a referendum taken by the Chamber of Commerce of the United States, made public in Washington on June 23, 698 trade bodies, such as chambers of commerce, boards of trade, etc., of the country are shown to be opposed to the purchase, construction or charter of vessels for mercantile purposes and their operation by the United States government, as compared with 82 such bodies in favor of such a proposition.

On the question of ownership of merchant vessels by the government with operation by private parties under lease, 711 trade bodies declared themselves opposed and 54 voted in favor of it.

Asked whether they favor subsidies from the government sufficient to offset the difference in cost between operation of vessels under the American flag and operation in the same deep-sea trades under foreign flags, 558 trade bodies voted in favor of such a plan with 186 opposed.

When asked whether they favor subventions from the government to establish regular mail and freight lines under the American flag to countries in which the commercial interests of the United States are important and to the American dependencies, the trade bodies voted 718 in favor and 48 opposed.

They voted for the establishment of a shipping board to investigate and report to Congress regarding navigation laws and to have control of all matters pertaining to over-sea transportation. They recommended that the government subscribe to the entire capital stock of a Marine Development Company, capital $30,000,000, this company to have authority for seven years to lend under supervision of the federal shipping board on security of first mortgages on merchant vessels, taking as evidence of indebtedness bonds which bear interest and contain provision for amortization, the company to guarantee the bonds as to principal and interest and sell them to the public. The vote on the latter proposition was 422 in favor and 314 opposed.

Electrical Jobbers Vote on Ship Subsidy

Interested as merchandise distributers in measures which affect transportation, the members of the Electrical Supply Jobbers' Association at Detroit, on June 15 to 17, voted as follows on the ship-subsidy questions submitted by the Chamber of Commerce of the United States:

"Do you favor the government undertaking the purchase, construction or charter of vessels for mercantile purposes, together with the operation of such vessels?" *No.*

"Do you favor ownership of merchant vessels by the government but with operation by private parties under leases?" *No.*

"Do you favor subsidies from the government sufficient to offset the difference in cost between operation of vessels under the American flag and operation in the same deep-sea trades under foreign flags?" *Yes.*

"Do you favor subventions from the government to establish regular mail and freight lines under the American flag to countries in which the commercial interests of the United States are important, and to American dependencies?" *Yes.*

"The committee recommends the creation of a federal shipping board to investigate and report to Congress regarding the navigation laws and to have full jurisdiction, under the law, in all matters pertaining to over-sea transportation." *Yes.*

"The committee recommends that the government subscribe to the entire stock of a Marine Development Company with a capital of $30,000,000, this company to have authority for seven years to lend, under supervision of the federal shipping board, upon the security of first mortgages on merchant vessels, taking as evidence of this indebtedness bonds which bear a fair rate of interest and contain provisions for amortization, the development company to guarantee the bonds as to principal and interest and sell them to the public." *Yes.*

"The committee recommends that the ocean-mail law of 1891 be amended by lowering the speed for first-class steamers from 20 knots to 16 knots and for second-class steamers from 16 knots to 12 knots, and by making the compensation adequate to permit the establishment of lines of steamships carrying both mail and freight." *Yes.*

"The committee recommends that there should be legislation abolishing deferred rebates and providing for supervision of rates by the federal shipping board, with requirements for filing with the board schedules of rates and all agreements among over-sea lines." *Yes.*

"The committee recommends that federal licenses should be taken out by lines, domestic and foreign, engaged in shipping between ports of the United States and other countries." *Yes.*

Milwaukee Street Lighting

On June 21 Mr. F. A. Vaughn, of Vauhgn, Meyer & Sweet, Milwaukee, presented his report on the Milwaukee street-lighting survey to the Commissioner of Public Works. He recommended the use of gas-filled tungsten lamps with mantle gas lamps as possible alternatives for certain locations, and the use of prismatic refractor-type globes throughout the system. He also recommended that entirely new street-lighting circuits, to be owned and maintained by the city, be installed and that energy be supplied by the use of transformers with adjustable taps and without the use of constant-current regulators. He recommended the use of self-winding time switches to control the lamp circuits, the use of an individual compensator for each lamp, and the use of a total of 8500 lamps. He recommended that the street-lighting contract be made on the kilowatt-hour basis for a term of five years, and suggested the enactment of legislation prohibiting the installation by private owners of any street lighting except such as complies with the standard described in the report.

In typical installations on residential streets 400-cp lamps hung 22.5 ft. high on center suspensions at the street corners were recommended, 100-cp lamps on 15-ft. bracket posts at the curb line midway between street intersections being used to augment the illumination in blocks more than 420 ft. in length. For business streets Mr. Vaughn advised that a pair of 30-ft. posts be installed on opposite sides of the street every 180 ft. Each post is to carry two 1000-cp lamps. Semi-residential streets should be lighted, the report said, by 400-cp lamps 22.5 ft. above the street on 360-ft. centers, and outlying business streets should be lighted by 600-cp lamps on 22.5-ft. bracket posts at the curb line on 180-ft. centers. At certain squares and open places it was recommended that lamps be hung at a height of 45 ft.

With the system as proposed in operation, the cost of street lighting will be increased from 60 cents to 75 cents per capita, a figure slightly below the average street-lighting expenditure in other cities of similar size.

Special Telephone Rate Contracts Disapproved

Justice McCoy of the District of Columbia Supreme Court has rendered a decision denying an appeal for an injunction to prevent the Chesapeake & Potomac Telephone Company from canceling contracts for "flat-rate" business service. The injunction was sought by Mr. Jesse L. Heiskell, a Washington business man, as representative of an association of business houses in the District of Columbia which have been furnished unlimited telephone service at a flat rate.

When the District of Columbia public utilities act was passed the company had in operation 188 contracts for flat rates to business houses and 6900 for "measured" service. The company gave notice of its intention to discontinue the flat service, and sought to have the plaintiff enter into a contract for measured service. He declined and brought suit to enjoin the discontinuance of service, claiming that the company had no right after the passage of the public utilities act to discontinue his contract.

In his decision Justice McCoy said: "The decision of plaintiff's motion turns particularly on the construction of paragraphs 24, 30 and 94 of the section. There were rates fixed by statute and rates not so fixed when the act was passed. The rates in question here were not statutory rates, but those fixed by the defendant.

"It must be assumed that Congress knew not only that all rates were not regulated by statute but also what the situation was in the District of Columbia in regard to rates generally; therefore it dealt knowingly with a situation in which rates for telephone service were given to the plaintiff under a contract of many years' standing and of a kind which for years it had declined to enter into with any one, whereas others than the plaintiff and those similarly situated, if they wished telephone service, have been and now are obliged to contract for 'measured' rates."

Standard Tests of Insulating Materials

At the annual meeting of the American Society for Testing Materials, held at Atlantic City, N. J., June 22 to 26, Mr. C. E. Skinner, East Pittsburgh, Pa., chairman of the committee on standard tests of insulating materials, reported that during the year considerable work has been done by members of the committee in formulating standard tests for molded insulating material, sheet insulating materials, and liquid insulators. A sub-committee on porcelain has also been appointed. Trial specifications for molded insulating materials have been submitted to members of the committee and to others. Specifications for sheet insulating materials have also been made up and are under test by members interested in the subject. While the committee is not yet ready to submit tentative specifications to the society, it expects to be able to present one or more such specifications next year.

City of Cleveland Seeks Company Service

The Cleveland Electric Illuminating Company has been asked by the city of Cleveland to make arrangements to furnish steam heat to the new city hall on the lake front, which is nearing completion. City officials, however, received the information in reply that the cost of laying pipes to the building, since there are no other customers in the vicinity, will be too great to justify the company in taking a contract for heating it. Statements of city officials indicate that it is probable that an attempt will be made to force the company to furnish the heat for the building.

ELECTRICAL DEVELOPMENT IN RUSSIA

Rapid Progress Before the War and Prospects After the Conclusion of Hostilities

BY LUDWIG W. SCHMIDT

Before the war the demand for electrotechnical goods in Russia had increased steadily. A large electrical manufacturing industry had developed in Russia, but the rapid expansion of electrical enterprises throughout that country had outstripped the producing capacity of the manufacturing industry there, and Russia had been forced to make up the deficiency in electrical goods by purchases abroad. As a result of this condition Russia had become an excellent market for all electrotechnical goods, and the outlook for the foreign maker was excellent.

Before the war, according to a Russian estimate, Russia had about 2000 electrical plants of some importance. It had 190 telephone systems, with over 170,000 stations and nearly 300,000 miles of wire. The value of those systems has been estimated at about $19,000,000 and the annual income at $5,000,000. The telegraph system had been increased largely. In 1913 alone about 500 new stations were added, while wireless telegraphic facilities were being built up rapidly. The telephone system of Petrograd increased from installations of 0.2 per cent per 100 inhabitants in 1895 to 2.2 per cent per 100 inhabitants in 1911, the last year for which such statistics are available. While the telegraphic system is entirely in the hands of the government, the telephone system was taken over only recently, and there are still a number of cities where telephone service is carried on by private enterprise. Electric light is furnished in nearly 100 cities, three-quarters of which are in Russia proper, while the remainder are in Poland and Siberia.

Study of Hydroelectric Opportunities

This was the position before the war. During the last year, of course, great changes have taken place, but it seems certain that, notwithstanding the present occupation of the empire, a large number of the electrical enterprises contemplated before the war have been continued. A few years ago the government formed an imperial commission for the study of hydroelectric energy in Russia. This commission made a report some time ago from which it appears that the Russian waterways offer a great many opportunities for the installation of hydroelectric generating plants.

The first sign of the growing interest in this direction may be seen in the great number of municipal electrical enterprises which had been started just shortly before the war. Only a few can be mentioned. Moscow was planning to spend more than $4,000,000 on a new extension of the present electric-railway system. It was planned to use water-power in a new overland system in the Caucasus district by the help of the Samur River. The cities of Tuckum and Kolonna had started to erect an electric-light plant. In Kiev, a large center for general electric enterprises, a new company had been founded to operate an electric tramway between Kiev and Danitza. A new tramway was to be built between Petrograd and Tsarskoye Selo, the residence of the Czar. Tashkent was to receive a new central electric station, while Charcow had voted $350,000 for a new central station and $120,000 for an electric-railway system. English capital, which had previously held back somewhat from Russian electrical enterprises, had offered assistance in the erection of a generating station and electric railway in Wladikawskas. It was the intention to spend $600,000 on a new central station and electrical enterprise in Nishny Novgorod. Archangel, according to the plans, was to

have a new electric railway involving an expenditure of $1,750,000 and Poltawa a new railway costing $500,000. There was also a project to build a new electric-railway system and electrical power plant in Wilna with an expediture of $2,000,000, and several others in different parts of the Empire were in abeyance.

Great Increase in Demand

The surprising growth in the demand for all kinds of electrical goods in Russia is one of the most prominent features in electrical development in the whole of Europe during the period before the war. Since 1912 Russia has nearly doubled its imports of electrotechnical goods of all descriptions and has increased largely the production of its own electrical industries. Russia imported during 1913, the last year for which full official figures prepared by the Russian government are available: Electrical machinery, $2,787,500; transformers, $352,000; transformer parts, $180,500; accumulators, $14,500; switchboards, etc., $165,500; lamps, $500,000-$600,000 (an alteration in the method of recording was made in this class); cables, $38,750; low-tension apparatus, $90,750; carbon rods, $88,000. Part of the large increase was brought about by large government orders which have played a considerable part in electrical enterprise and development in Russia during recent years.

The United States, as well as Germany, Austria, France, Belgium and England, has been an exporter of electrotechnical goods to Russia. Germany, Austria, England and France have supplied a large number of the lamps imported by Russia. Lamps were made in considerable number in Russia, especially by a firm in Poland which has been a large producer, but engineers and the public have shown marked preference for the imported lamps, which were supposed to be of better quality and higher resisting power. The introduction of metallic-filament lamps added largely to the increase in the sales of imported lamps. Globes for arc lamps were manufactured mostly in Bohemia and imported by Russia from there, while carbon rods for those lamps are already made in good quality in Russia as, for instance, by two firms in Lublin and Moscow. The imports of cables have not been very important for a considerable number of years as large quantities of cables are manufactured in Russia by a number of firms which have combined in a syndicate holding a very strong position in the market. The same statement may be made in regard to all porcelain goods such as insulators, etc., as well as all goods made from rubber. Those are made by the Russian rubber works, which hold a practically unassailable position. Italy has been supplying a large number of ventilators, which are imported by Russia to some extent from Germany also. Plugs are imported from France, Germany and Italy, while Germany, Switzerland and England furnish the leading amounts in the imports of all kinds of dynamos.

American Sales of Generators and Motors

Looking into the American participation in the Russian business, it seems that until now American manufacturers have been interested mostly in the sale of generators and motors. The sale of both promises to increase enormously after the war. Russia has just reached that period of its industrial life when the employment of electrical energy is imperative. As it has reached that state in a period when the use of gas is decreasing and electric and internal combustion motors begin to control the field, it is practically certain that Russia will take up at once the generation of electrical energy on a larger scale. The first steps in this direction have been taken already, and the period following the conclusion of the war will see a further favorable development. It is likely that the United States will benefit as much from the general development of Russian enterprises as all the other countries making electrical goods have done.

The new United States commercial attaché to Russia has pointed out already the influence of international finance in Russian industrial development. It is possible that finance has exercised a larger influence in the development of the electrical industry of that country than in similar progress in any other country. Two countries have been doing pioneer work in this direction, Germany and Belgium. All of the leading German electrical enterprises have been represented or have had works in Russia. It is sufficient to mention such names as the Allgemeine Elektricitäts Gesellschaft, Siemens & Halske, Schuckert & Company, and a special company under the name of Siemens. The Russian cable works were practically a German concern as well as the Russian Siemens-Schuckert works for high-tension systems founded a short time ago.

Aid by Financing

All of these companies have been interested to a greater or lesser extent in a number of Russian electrical enterprises, financing them or taking over part of the shares or helping them along in some other way, and, of course, securing in this way the large orders for electrotechnical goods which have gone to Germany from Russia. A leading part in Russian electrical enterprises has always been taken by the "Gesellschaft für Beleuchtung vom Jahre 1886" in Petrograd. This company, which has a capital of over $20,000,000, consisting of preference and ordinary shares, and was planning before the war to add about $5,000,000 more, was an influential element in the entire electrical progress of Russia. The controlling interest in it belonged to the Bank of Electrical Enterprise in Zurich. The company named and others in which German influence was real or suspected were taken over by the Russian government after the outbreak of the war. The leading companies have been dissolved by government.

Germany exported to Russia electrical goods of all classes, as shown by the following from the German statistics for 1913: Generators and motors 25 kg, $158,750; generators and motors 25 kg to 100 kg, $323,500; generators and motors 100 kg to 500 kg, $398,250; generators and motors more than 500 kg, $811,750; cables, $44,250; arc lamps, $163,000; searchlamps, $125,000; metallic-filament lamps, $1,824,000; carbon-filament lamps, $192,000; telegraph material, $47,000; telephone material, $269,750; signal apparatus, $151,750; wireless apparatus, $27,750; material for transmission of energy for light and motor service, $2,241,750; chirurgical apparatus, $223,500; meters, $1,061,750; batteries, etc., $67,000; heating and cooking apparatus, $80,250; insulating material, $98,250. The German official figures are somewhat higher than the Russian official figures, owing apparently to the Russian way of valuing imports.

The Belgian participation in the Russian business has been mostly in the direction of tramway financing. Of the twenty foreign tramway companies which were registered in Russia some time ago the headquarters of seventeen were located in Brussels and one in Liège. The Éclairage Électrique de St. Petersbourg and the Compagnie d'Électricité de Midi de la Russie were also established in Brussels.

Future development of the Russian electrical industry will depend largely upon the situation at the conclusion of peace. Everybody connected with Russian enterprise seems to be of the opinion that the recovery of the market will be rapid, but that possibly it may last for only a limited period of time.

Miscellaneous News Notes

Outing of Erie County Electric Company Employees.—An annual outing of employees of the Erie County Electric Company, Erie, Pa., was held recently at the Ruhl farm, Erie. Members of the operating force who attended went to the grounds in a large electric truck provided with seats. In the evening a banquet was held in their honor.

To Light Niagara with San Francisco Exposition Scintillators.—A movement has been organized in the sister cities of Niagara Falls, N. Y., and Niagara Falls, Ont., to acquire the battery of electric searchlamps now being used for the scintillator illumination at the Panama-Pacific Exposition at San Francisco, and to provide for the electrical illumination of the Falls during a number of months of each year.

How Chicago Street-Car Strike Increased Telephone Traffic.—Between 6 a.m. and 8 a.m. Monday, June 14, there was an increase of 300 per cent in the traffic of the Chicago Telephone Company. The company's records for the entire day showed an increase in business amounting to 50 per cent. Under normal conditions the average daily number of calls is 2,000,000, but the total number of calls Monday reached 3,000,000.

Baltimore Signs Must Remain Lighted Until 11 o'Clock.—All electrical signs in Baltimore, Md., must hereafter be kept lighted until 11 p.m., according to an order issued by the local Board of Estimates. When illuminated the signs, it is conceded, add to the appearance of the streets, but the bare outlines of the structures when dark are deemed unornamental and will not be tolerated, under penalty of annulment of the owner's permit.

"Home Rule" Fails in Illinois.—The measure known in the Illinois Legislature as the "Mayor's home rule bill," which provided for regulation of Chicago's public utilities by a commission appointed by the Mayor, was not passed in the final and hurried sessions last week. Mayor William Hale Thompson of Chicago, who has endeavored to secure enactment of the bill, has announced that the home-rule fight will be renewed in the next legislative campaign.

A Swiss Power Plant's Difficult Rôle of Neutrality.—Switzerland, surrounded by warring nations, is under continual surveillance for any breach of her neutrality. One of the more delicate situations is that of a power house near Basle on the Rhine, which furnishes electricity for a fort on the German side. Here, day and night, Swiss and German guards face each other, the former to see that there is no increase in the amount of energy transmitted and the latter to see that there is no reduction.

Plans for Los Angeles Bonds.—The city of Los Angeles, Cal., will invest $390,000 of its sinking-fund payments in the purchase of the bonds authorized by the city for completion of the generating plant in San Francisquito Canyon. This was decided after a conference between representatives of the Water Department and the budget committee. It will permit the city to continue construction of the generating plant and distributing system until a sale of the remainder of the $6,500,000 bond issue is negotiated.

Tax Valuations in Ohio.—According to announcements made by the Ohio State Tax Commission, the State will collect a largely increased amount from light utilities in taxes this year. In some cases value has been added in the way of improvements. The value of the plant of the Union Gas & Electric Company of Cincinnati for tax purposes has been fixed at $17,594,730, an increase of $231,860 over last year. The Cleveland Electric Illuminating Company property is valued at $19,097,830, as compared with $17,792,560.

Central-Station Company May Use Wireless.—It is reported that wireless-telegraph apparatus may be installed by the Harwood Electric Company and the Lehigh Navigation Electric Company for emergency communication between their power stations at Hauto and Harwood, Pa., and their substations at Siegfreid, Hazleton, Freeland, Danville, Berwick, Bloomsburg, Tamaqua, Mahanoy City, Shenandoah, Lansford and McAdoo, Pa. The equipment, it is said, will be modeled after that in use by the Delaware, Lackawanna & Western Railroad for train dispatching.

Winking of Lamps Reported Election Results.—Customers of the Union Electric Light & Power Company, St. Louis, Mo., learn the results of city elections electrically by means of prearranged signal "winks" of the lamps supplied from the company's lines. News that the plan to build a central traffic parkway had been defeated at a recent election was received in the evening at 8:30. All electric lamps in the city except street lamps were extinguished for an instant, and then after a lapse of five seconds they again went out for another instant. Had the project won the lamps would have been extinguished but once.

Electrically Operated Dredge of Minneapolis Park Board.—At Lake Nokomis, near Minneapolis, Minn., the Minneapolis Board of Park Commissioners has in service an electric dredge, energy to operate which is furnished by the Minneapolis General Electric Company. The hoisting machinery is operated by a 30-hp motor, and the cutter ladder and cutter drive machinery, which complete weigh about 20 tons, are operated by a 50-hp motor. The bilge pumps are driven by a 10-hp motor. A 10-kw motor-generator set supplies energy for the dredge lighting system, from which are operated a 6000-cp searchlamp, two arc lamps and forty incandescent units.

Brooklyn Edison Company Grants Full Pay to Employees in Militia Camp.—An official of the Edison Electric Illuminating Company of Brooklyn, in granting leave of absence with full pay to one of the company's employees who is a private in the State National Guard and desired to take part in the encampment of his regiment, made the following statement: "Any employee who is ordered to duty as a member of the National Guard is required only to obtain in writing from his commanding officer a statement of the date covered by his order, in order to obtain leave of absence with full pay for the entire period. This absence in no way interferes with the employee's regular vacation."

A 21,000-hp Water-Power Plant in India.—In a paper on the Cauvery power scheme, read at a conference of the Mysore (India) Engineers' Association, Mr. S. G. Forbes, chief electrical engineer, said that the fourth installation of 4000 hp is practically complete. This, with a fifth installation of 4000 hp contemplated for next year, will make 21,000 hp generated at the falls. Under the new agreement with the Kolar mining companies, working 92 miles away, the Mysore government is to supply them with a total of 14,321 hp at the motor terminals after July 15 of this year, with an option of 2500 hp more on two years' notice to the government. Practically all of the electrical machinery in the project is of American manufacture.

Lightning's Prank Turns Trolley Pole Into Waterspout.—Lightning struck a tubular-steel pole supporting trolley wires in the Bronx, New York City, June 22, burning the wires and messengers loose and allowing them to fall into the street. A few minutes later water began to spout from the top of the pole and to ooze from the joints, making the pole a veritable fountain. Investigation showed that the lightning had ruptured a water main beneath the pavement, and that the path provided by the tubular pole was the only means of escape for the leaking water. Since to shut off the main would have deprived a large district of its water supply, the impromptu fountain was allowed to run during the night, and the main was repaired next day.

Examination for Illuminating Engineer.—An examination for illuminating engineer will be held by the United States Civil Service Commission on July 7 and 8 to fill vacancies at $1,200 a year in the office of the supervising architect, Treasury Department, Washington. This examination supersedes the examination for electrical engineer and draftsman mentioned in the ELECTRICAL WORLD dated June 5, page 1490. Applicants must have the equivalent of a high-school education and not less than three years' special experience as draftsmen, principally in connection with electrical work and illuminating engineering, or be technical graduates with not less than six months' experience as electrical draftsmen or practical experience in the installation of electrical wiring or apparatus. Persons desiring to take this examination should apply for Form 1312, stating the title of the examination for which the form is desired, to the United States Civil Service Commission, Washington, D. C.

Central-Station Men May Receive Red Cross Certificates.—The educational committee of the Boston Edison company announces that the results of the mid-term examination in its first-aid course are very gratifying. If a sufficient number take up the advanced course next fall, arrangements will be made with the American National Red Cross so that certificates will be awarded by that society to those who pass a creditable examination on the general subject of first aid.

Valuation of Utah Utilities.—The Utah Board of Equalization has announced appraisals for the purpose of taxation of the public service corporations of Utah. The present total valuation is placed at $55,443,448, an increase of $1,394,235 over the valuation for 1914. Interurban railways have a valuation placed at $5,698,823. Light and power companies are valued at $2,757,736. The Utah Power & Light Company is appraised at $2,586,797, and the Utah Light & Traction Company is appraised in the sum of $4,095,208.

Lightning Rods Reduce Property Damage.—In the annual report of Mr. W. E. Longley, State fire marshal of Indiana, attention is called to the fact that, as a result of the increasing use of lightning rods on farm buildings, only 453 cases of lightning damage were reported in Indiana during 1914, compared with 1006 during the preceding year. "Lightning rods properly placed afford certain protection," declares the fire marshal, "for only seven buildings equipped with rods were struck during 1914. In these seven instances investigation showed that the rods either had gone a long time without proper attention or were not properly grounded."

Gas-Filled Lighting at Sandusky, Ohio.—A complete new lighting system is being installed at Sandusky, Ohio, by the Sandusky Gas & Electric Company, which recently closed a ten-year contract with the city for its operation. A conspicuous feature of the new system is a "white way" covering the business section of the city, a total of some fourteen blocks. The installation will consist of 190 ornamental standards, each bearing two 250-cp nitrogen-filled lamps. When the lamps were lighted for the first time a public celebration with a civic parade and band concert marked the event. The city is lighted with 1300 nitrogen-filled tungsten lamps of sizes ranging from 250 cp to 60 cp.

Central-Station Pulmotor Saves Drug Victim.—The pulmotor of the Muskogee (Okla.) Gas & Electric Company recently saved the life of a man who was found unconscious from an overdose of a drug. The first physician to reach the victim held out no hope of recovery, but a second called for the company's pulmotor. The machine was kept in operation continuously for four and a half hours, and at the end of that time the patient regained consciousness and was able to be removed to his home. The physicians who worked on the case were emphatic in stating that except for the pulmotor the man would have died. One physician declared that "the man had completely suspended respiration before the pulmotor arrived."

Dual Ownership of Utilities in Strassburg, Germany.—In Strassburg, Alsace-Lorraine, Germany, the central station, street-railway and gas works are owned and controlled jointly by the municipality and private capital. The municipality gained its first hold on the electric works in December, 1908, when it granted to the Strassburg Electric Company a concession until the year 1940 in consideration of 40 per cent of the 11,750 shares of the company at 1000 marks ($238) each, and three seats on the board of ten directors. In February, 1909, the city purchased 1182 more shares of stock, thus gaining a controlling interest. So far this dual plan of ownership and control has, it is claimed, worked out well, and the demand for electrical energy both for lighting and motor service has increased rapidly. The company has returned 11 per cent dividends, besides paying royalties to the city on its surplus profits amounting to about $100,000 in 1911 and to about $130,000 in 1913.

Maintenance of Resale Prices.—The Chamber of Commerce of the United States' committee on the maintenance of resale prices is preparing a report for the board of directors which will include a statement of arguments in favor of and against the practice indicated. The committee, of which Mr. Paul T. Cherington, Harvard University, Cambridge, Mass., is chairman, is seeking evidence bearing on its inquiry and asks that this be sent by any individual, corporation or association. The evidence sought by the committee includes cases showing whether there is an essential distinction between goods identified by brand or otherwise and unidentified goods to the advantage of the former from the consumer's point of view; whether advertised or unadvertised goods are more economical for the consumer to purchase at the same price; whether or not legislation is desirable or necessary to require truthful advertisement and description of merchandise; whether or not competitive conditions prevent exorbitant profits on identified merchandise and on unidentified merchandise; whether or not price cutting actually reduces the value and hinders the distribution of identified goods; whether or not price cutting helps or hinders the reduction of distributing costs, and whether or not price cutting reduces the quality standards of identified articles.

Bill Governing Competition in Connecticut.—The judiciary committee of the House of the Connecticut Legislature has reported a bill amending Section 3916 of Chapter 254, under which producers of electrical energy for their own use have had authority to dispose of the surplus to neighbors in the same block. The new section provides that the Public Utilities Commission, subject to the right of appeal, shall have exclusive jurisdiction over the method of construction or reconstruction of every system used for the transmission of electric energy and over all the plant and apparatus used for generating electric energy on private property and for its transmission. The commission shall have authority to make all necessary orders. Any corporation authorized by the Legislature to sell or distribute electric energy to electric light and power companies, railroad companies, street-railway companies or electric companies may sell, transmit and deliver energy to any person or corporation desiring to use energy for any use incidental to or connected with manufacturing purposes. No corporation shall exercise the privileges within the territory where any private corporation shall be engaged in the business of selling and distributing energy for light, heat and power unless it shall have given notice to the commission. If the commission finds that the proposed action of the company making application will impair the public service in any manner, or subject the public to any material inconvenience by reason of additional lines, poles and fixtures, or impair the financial condition of the company already in the field so that it will be unable to furnish adequate service to its customers and to pay "a reasonable dividend upon its investment, within the State," the company making the application to enter the field shall be denied.

Associations and Societies

Telephone Pioneers to Meet.—The fifth annual meeting of the Telephone Pioneers of America will be held in San Francisco Sept. 21, 22 and 23, with headquarters at the St. Francis Hotel. Mr. R. H. Starrett, 15 Dey Street, New York, is secretary of the association.

American Society of Refrigerating Engineers.—The fourth Western meeting of the American Society of Refrigerating Engineers will be held at San Francisco, Cal., Sept. 23 and 24, during the week of the International Engineering Congress. Mr. W. H. Ross, 154 Nassau Street, New York City, is secretary.

United Technical Societies of Los Angeles.—More than 100 people attended a dinner recently of members of seven technical societies of Los Angeles, Cal. Mr. C. T. Leeds, as chairman, said that it was the aim of members of the various technical associations represented to have regular gatherings through an organization to be known as the United Technical Societies of Los Angeles. The committee on arrangements has invited Gen. George W. Goethals of the Panama Canal to be the guest of honor and the principal speaker at the next meeting, to be held in September. At the organization meeting the principal speakers were Messrs. William Mulholland and Samuel Storrow and President James A. B. Scherer of Throop College of Technology.

A. I. E. E. Convention at Deer Park, Md.—The annual convention of the American Institute of Electrical Engineers, as already announced in these columns, will be held at Deer Park, Md., June 29 to July 2.

Lehigh Valley Section, N. E. L. A.—An address on "General Features of Organization of a Public Utility Corporation" by Mr. A. H. S. Cantlin, superintendent of the Lehigh Valley Light & Power Company, was the feature of the annual meeting of the Lehigh Valley company's section, N. E. L. A., at Allentown, Pa. The election of officers, which preceded the address, resulted in the selection of Mr. Taylor Fogle as chairman, Mr. T. H. Tyson as vice-chairman, Mr. H. M. Schaeffer as secretary, and Mr. R. C. Dornblazer as treasurer.

Chicago Section, A. I. E. E., Elects Officers.—At a joint meeting of the Chicago Section of the American Institute of Electrical Engineers and the Western Society of Engineers at Chicago, June 21, announcement was made that officers for the A. I. E. E. section for 1915-16 had been elected as follows: Chairman, Mr. William J. Norton; secretary, Mr. Taliaferro Milton; member of the executive committee, Mr. E. W. Allen. The paper of the evening, "The Application of Diversity-Factor," by Mr. H. B. Gear, was abstracted in the ELECTRICAL WORLD on June 12.

Chicago Section, Illuminating Engineering Society. — At the meeting of the Chicago Section of the Illuminating Engineering Society, June 22, Prof. Edward L. Nichols, of Cornell University, Ithaca, N. Y., presented a paper entitled "Artificial Lighting in 1900 and in 1915." The paper reviewed the advance in electric and gas lighting. The result of the election of officers of the section for the ensuing year was as follows: Chairman, Mr. E. W. Lloyd; secretary, Mr. Otis L. Johnson, and managers, Messrs. A. O. Dicker, H. M. Frantz, C. A. Luther, A. H. Meyer and F. A. Rogers.

General Electric Furthers Work of Employees' Mutual Benefit Association.—At a meeting of the directors of the General Electric Company held at Lynn, Mass., June 3, it was voted to give the beneficiary or beneficiaries of the General Electric Mutual Benefit Association $100 in addition to the $100 that goes to them from the association. The rule applies to all plants of the company. The association is unlike others in that members are required to pay dues, which are but 10 cents a week, only when the treasury of their respective section is at low ebb. In some sections the results of this ruling are that its members are exempt from dues as much as six months of the year. When any member of the association is unable to continue work through illness he receives a benefit of $6 a week and the services of the company's physicians until well again.

Annual Meeting of Brooklyn Company Section, N. E. L. A. —The Brooklyn Edison Company Section of the National Electric Light Association held its seventh annual meeting at Manhattan Beach, New York City, June 23, attended by practically its entire membership of 900. The program included abstracts of the following papers and reports read at the recent San Francisco convention of the N. E. L. A.: "Analytical Accounting for Central Stations," by Mr. O. B. Coldwell; "Revivals," by Mr. Paul Lüpke, and the reports of the committees on meters, public poliey, prime movers, lamps, wiring of existing buildings, underground construction, and electrical apparatus. Mr. T. I. Jones followed with a talk on commercial activities, and Mr. E. A. Leslie described the interesting features of the trip across the continent to San Francisco. The meeting closed with a banquet tendered the members of the section by the officers of the Brooklyn Edison company. During the evening addresses were delivered by Mr. W. F. Wells, general manager of the Brooklyn company, and Mr. Joseph B. McCall, president of the Philadelphia Electric Company. Announcement was also made that the Brooklyn company section now stands second in point of membership among company N. E. L. A. sections, the Chicago section being the only one which exceeds it in numbers. The Brooklyn section is also the first to capture in a single year both the Doherty and the Harriet Billings prize for excellence of work during the 1915 competitions. Results of the election of section officers were announced as follows: Chairman, Mr. C. W. Hafstrom; vice-chairman, Mr. E. F. Dempsey; secretary, Mr. Treve Collins; financial secretary, Mr. E. K. Ponbert, and treasurer, Mr. F. C. Hill.

Public Service Commission News

New York Commissions

The Second District commission has made its final return on the expense to the State for the New York Telephone Company investigation. An appropriation of $100,000 was given to the commission by last year's Legislature. The commission returns $56,567. The total expense was, therefore, $43,433. The items included in this sum are: Salaries of engineering and accounting forces, $31,272; traveling expenses, $1,851 (including trips of commissioners to New York City for hearings); equipment, $2,132; supplies and miscellaneous expenses, $657, and services and expenses of special counsel, Mr. Martin W. Littleton, $7,521.

Upon motion of Commissioner William Hayward, the First District commission has appointed a committee of two on informal complaints. Chairman McCall appointed Commissioners Hayward and George V. S. Williams as the committee. At least once in two weeks this committee will review all informal complaints and the correspondence connected therewith, and report to the commission what action should be taken to obtain effective results.

Pennsylvania Commission

The commission has dismissed the petitions of the East End Electric Light, Heat & Power Company and the Relief Electric Light, Heat & Power Company for certificates of public convenience approving the ordinance contracts with the boroughs of East Washington and Washington. These companies sought to compete with the West Penn Electric Company, but no evidence was presented to show that the service rendered by the latter is inadequate or that the rates were unjust and unreasonable.

Michigan Commission

Dean M. E. Cooley of the University of Michigan, Ann Arbor, Mich., has been employed to make an appraisal of the property of the Detroit Edison Company. The order was issued on June 16 by the Railroad Commission, virtually at the request of the Detroit Edison Company, which will pay for the work. If the figures which the Edison Company has offered are correct, the appraisal should show property valued at close to $100,000,000. Some time ago the Detroit Edison Company applied to the commission for the privilege of consolidating all of the underlying companies and issuing a mortgage for $75,000,000. Of this sum, $14,000,000 was to be used in retiring the present bonded indebtedness of the underlying companies. The application also called for the immediate issuance for sale of $5,500,000 bonds. The commission sanctioned the consolidation, but deferred action on the bonds until appraisal could be made. The amount of bonds which the company wishes to issue at this time has been reduced from $5,500,000 to $3,500,000.

Indiana Commission

The commission has ruled unofficially that the "present value" placed on a public utility by the commission may be used as a basis for either rate-making or sale purposes. The opinion was given during a hearing on the case in which the city of Richmond asked authority under the utility law to purchase the plant of the Richmond Light, Heat & Power Company. The commission engineers fixed a "present value" of about $161,000 on the plant and the city declared that this valuation was too high. The company contended that when the City Council passed its resolution providing for the initiation of condemnation proceedings the obligation of the city to buy the plant was closed legally and the purchase had to be completed. At the same time Chairman Thomas Duncan made the ruling as to "present value." Mr. Harry O. Garman, chief engineer of the commission, had been holding that a difference in values for rate-making and sale purposes should exist. The commission, through Chairman Duncan, expressed the belief that if there is any difference in values for the two purposes the value for purchasing purposes never would be lower than the value for rate-making. The city of Richmond operates an electrical plant and the purchase of the private plant would create non-competitive conditions. No ruling on the Richmond question has been made.

The Southern Indiana Power Company has asked for authority to revise rates and rules.

The Gary Heat, Light & Power Company has filed a petition asking the commission to declare invalid an ordinance of the Gary City Council which would require unprofitable investments in the extension of service lines.

The State Board of Accounts has given an opinion to an official of Terre Haute on witness fees. Mr. G. H. Hendren, State examiner of the board, says in part in the opinion: "The city may not in my judgment pay the car fare, hotel fare or other expenses of its witnesses in cases before the commission. This statement does not apply to the engineer who testified as an expert, nor to the expenses of the city attorney. The city has the power to contract to pay an engineer a reasonable sum for his expert services, including his expenses, and to pay the expenses of its attorney when necessarily away from home on its business."

Maine Commission

The commission has rendered a decision on the application of the Bangor Power Company for authority to issue securities. While upholding precedents established in New York cases to the effect that a corporation cannot issue bonds to reimburse itself for money which it had previously taken from the treasury, the commission felt that these rules should not be applied literally without qualifications as to conditions. The commission says in part:

"If a utility expends moneys from its surplus for the acquisition of new properties, or for extensions and betterments, which it apparently does not then need as working capital, with no present intention of replacing it, except from earnings, and later, under changed conditions or business depression, seeks to restore it in this manner, we doubt very much if authority legally could be granted. When, however, during the course of such acquisition or construction it uses available funds not immediately required for current normal expenses and charges, in the expectation of reimbursing its treasury when the work is completed or when such funds are required for such current purposes, it amounts in effect to a temporary deflection or borrowing of money intended for those purposes and to a certain extent impressed with a trust or obligation that they will be so available. It does not seem that such a course is inconsistent with a fair construction of the statute. To hold otherwise would certainly impose a hardship upon the corporation, and ultimately upon the public who must pay the bills, because it would force the corporation, in order to save its rights, to borrow and pay interest as it went while funds temporarily available were lying idle in its treasury. This apparently was the view taken of the business wisdom of the practice in New York State, when, after the above ruling, the law was amended to provide for just such contingencies.

"It may not be easy always to determine under this construction of the law just what interpretation is to be placed upon the facts in a given case, but it is not difficult in the present case. The petitioner had executed its mortgage in 1911, under which it was entitled to receive from the trustee at any time bonds to the amount of $1,060,000. The balance of the authorized amount, $1,440,000, was to be certified and delivered 'from time to time to reimburse the mortgagor company for the actual cost of extensions,' etc., 'to an amount in face value of such bonds not to exceed 85 per cent of such actual cost.' It has been the policy of the corporation to proceed with such work and from time to time to take down such amount of bonds as it might under that provision. It had so taken down $192,000 before the present act became operative. It did the work for which the present issue is sought during the first six months of 1914. Action was taken by its directors to procure certification of these bonds by the trustee on Nov. 19, 1914. We think that the case clearly shows that the petitioner proceeded in good faith in the expectation that the proceeds from the sale of these bonds were to be made available to restore to the treasury expenses temporarily made to save unnecessary interest charges which would have been incurred by making temporary loans as the work progressed. We find that the sum of the capital to be secured by the issue of said bonds is required in good faith for purposes enumerated in Section 35, Chapter 129, Public Laws of 1913."

Personal

Mr. W. A. Trussell has resigned as superintendent of the Kirkwood (Mo.) electric-lighting plant.

Mr. C. L. Bernheisel has been elected president of the New Kingston (Pa.) Light, Heat & Power Company.

Mr. C. Remschel has succeeded Mr. J. G. Nusbaum as local superintendent of the Perris (Cal.) division of the Southern Sierras Power Company.

Mr. Luther J. Holton has been elected president of the Oro Electric Corporation, Oroville, Cal. Mr. Holton succeeds Mr. J. W. Goodwin.

Mr. C. M. Gassaway is manager and superintendent of the Seven Cities Company, which furnishes central-station service at Russellville, Ark.

Mr. Fred Sintes is the manager of the electric-lighting department which has been instituted by the W. M. Carney Mill Company of Atmore, Ala.

Mr. R. H. Sterling has succeeded Mr. John T. Huntington as manager and contracting agent of the Santa Barbara (Cal.) Gas & Electric Company.

Mr. James I. Dixon has been appointed superintendent of the municipal electric-lighting system of Santa Clara (Cal.), succeeding Mr. J. S. Worthington.

Mr. George F. Mueller has been appointed superintendent of the municipal light, power and water plant at Mascoutah, Ill., succeeding Mr. Charles Spani.

Mr. Cadwallader Evans has resigned as general manager of the Acadia Coal Company, Ltd., of Stellarton, Nova Scotia, and will go to California to take a rest.

Mr. Harland F. Stuart, formerly assistant superintendent of distribution for the Worcester (Mass.) Electric Light Company, has been appointed secretary of Hillyer Institute, Hartford, Conn.

Mr. L. F. Holmes, formerly of St. Catharines, Ont., has been appointed superintendent of the hydroelectric system at Port Dalhousie, Ont., succeeding Mr. W. R. Savigny, who goes to Merritton.

Mr. Charles H. Bryan, a brick manufacturer, has been elected president of the Detroit (Mich.) Public Lighting Commission. Mr. Bryan has been a member of the commission since April 4, 1913.

Mr. J. D. Scruggs, formerly vice-president of the Perry (Fla.) Electric Company, has been appointed president and manager of the company, succeeding Mr. George E. Porter, who becomes vice-president.

Mr. E. M. Herr, president of the Westinghouse Electric & Manufacturing Company, was awarded the honorary degree of master of arts by Yale at the university commencement exercises held at New Haven, Conn., June 23.

Mr. G. W. Wilson, who has been superintendent of the lighting department of the Tampa (Fla.) Electric Company, has been appointed manager of the St. Petersburg (Fla.) Lighting Company, and will take charge on July 1.

Mr. H. H. Arnold, engineer for the General Electric Company at Shanghai, China, is in the United States on a vacation. Mr. Arnold will return in September to the Orient, where he has served the company for the last four years.

Mr. Gilman W. Poore, who has been electrical engineer for the Milford Electric Light & Power Company, Milford, Mass., the last three years, has resigned that position. Mr. Poore is a graduate of the Massachusetts Institute of Technology.

Mr. L. F. Rye, of Detroit, Mich., has begun his duties as auditor of the Kentucky Utilities Company, the Kentucky Traction & Terminal Company and allied corporations, to which he was appointed recently. Mr. Rye takes the place of Mr. G. L. Langton, who resigned.

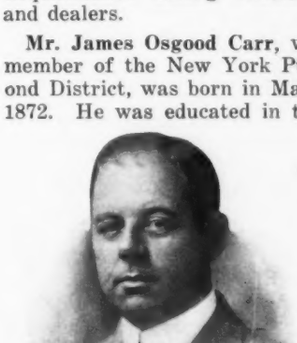
Mr. W. J. Ball, secretary of the Tri-City Electric Company, and manager of the company's Moline (Ill.) branch, has been elected president of the Moline Commercial Club. The club is the representative commercial body of Moline, a city of nearly 30,000 population. Mr. Ball is now serving his second term as president of the Illinois State Electrical Contractors' Association and has served several terms as president of the Tri-City Electrical Employers' Association.

Mr. Joseph Whittemore, who has been superintendent of the Gardner (Mass.) Electric Company's plant, has been appointed to succeed Mr. R. W. Berliner as general manager of the Colonial Power & Light Company, the Claremont Railway & Lighting Company and the Claremont Power Company, all of Claremont, N. H.

Mr. Harrison T. Matthew has been appointed Pacific Coast representative for the Society of Electrical Development. Born at St. John, N. B., in 1878, the son of Dr. George F. Matthew, a noted Canadian geologist, he received his early schooling at St. John, and came to the United States in 1898. Three years later he entered the employ of the McGraw Publishing Company and for six years served as business manager of *Electrochemical and Metallurgical Industry* (now *Metallurgical and Chemical Engineering*). Following this he was transferred to the Chicago office of the McGraw company as Western manager of the ELECTRICAL WORLD. For the last three years Mr. Matthew has represented the McGraw publications on the Pacific Coast, where he has a wide acquaintance among central-station men, manufacturers and dealers.

H. T. MATTHEW

Mr. James Osgood Carr, who has begun his duties as a member of the New York Public Service Commission, Second District, was born in Manchester, N. H., on August 24, 1872. He was educated in the public schools of that city. Entering the employment of the Thomson-Houston Electric Company at Boston, Mass., on Aug. 1, 1890, he continued in the service of that company and its successor, the General Electric Company, until May 1, 1915. Mr. Carr attended the New York University Law School in New York City in 1898-99 and was admitted to the New York State Bar in Brooklyn in May, 1899. From 1893 until May 1, 1915, he was connected with the law department of the General Electric Company and during that time was engaged principally in matters pertaining to the affairs of public service corporations. He acted at the same time as secretary and treasurer and counsel of the Schenectady Railway Company from 1900 to 1905, and was also connected in an official capacity and as counsel with the Schenectady Illuminating Company, the Mohawk Gas Company of Schenectady, the Schenectady Power Company, and the Hoosac River Electric Light & Power Company.



J. O. CARR

Mr. A. N. Connett, Jr., who has been appointed secretary of J. G. White & Company, Inc., and of the J. G. White Engineering Corporation, was graduated from the Rensselaer Polytechnic Institute in 1907 with the degree of C.E. and secured a position in interurban construction work with J. G. White & Company on the Buffalo, Lockport & Rochester Railway, where he was employed in the field engineering force until the latter part of 1908. From 1908 until 1911 he worked on bridge and building construction with J. P. Wright, of Buffalo, and in the structural steel plant of Jones & Laughlin in Pittsburgh. In 1911 he became connected with J. G. White & Company, Inc., as an assistant reporting engineer, which position he held until the early part of 1913, when he resigned to go to London as assistant to the commercial engineer of J. G. White & Company, Ltd. While with this company he made several investigations for the firm in South America. In July, 1914, he returned to New York to accept a position with the Engineering Securities Corporation, investment bankers, where he was employed until May of this year, when he resigned to accept the position to which he has just been appointed.

Obituary

Richard S. Brown, a salesman for railway apparatus in the Boston office of the Westinghouse Electric & Manufacturing Company, died June 5 in New York City. Mr. Brown was seventy-six years of age, and was at one time engaged in the early electric-railway exploitation work of the Daft Company. He joined the Westinghouse forces in 1890, and during his long service was extremely popular among the electrical men of New England and in great demand as a presiding officer at association meetings and banquets.

Dr. Emil Rathenau, founder of the German Edison Company and for many years managing director of its successor, the Allgemeine Elektricitäts Gesellschaft, Berlin, is reported dead at the German capital in a dispatch from that city by transatlantic wireless, June 21. Dr. Rathenau was a Privy Councilor, and in recognition of his distinguished work in organizing the electrical industry of Germany had been the recipient of many honors from Emperor William, the German government, the universities and engineering schools, and leading commercial and engineering organizations. He had, however, been in ill health for several years, and in 1912 suffered the amputation of a leg. Herr Rathenau was born in Berlin in 1838, received his academic education there, and, after an apprenticeship of four years in a machine shop, studied engineering at the Hanover Polytechnikum and at the Zurich technical high school. Leaving Zurich, he returned to Berlin to become engineer in the locomotive works of A. Borsig. Next he went to London, where he joined the staff of John Penn & Sons as technical draftsman in the design of large engines, and later on was employed by the English & Continental Steam Engine Improvement Company. In 1865 he returned to Germany and bought the mechanical engineering plant of M. Webers at Berlin. In 1876 Herr Rathenau visited the United States for a study of American industrial methods. While here he saw the first telephone, and on his return to Germany he endeavored to obtain a concession for a telephone exchange in Berlin, but was refused. In 1881 he acquired the German patent rights from the Continental Edison Company and founded a pioneer corporation for undertaking electric-lighting service by incandescent units. From this company the German Edison Company for Applied Electricity was formed in 1883, Herr Rathenau being the first director and general manager. This company later developed into the present Allgemeine Elektricitäts Gesellschaft, from which the Berlin Electricity Works were also later formed, Herr Rathenau having been managing director of both companies from the beginning. He held the degree of Dr. Ing. (doctor of engineering) from the Charlottenburg Technical High School, and was honored with the title of "Geheimer Baurat" by the German Emperor at the time of the imperial visit to the plant of "A. E. G." in 1900. Dr. Rathenau also possessed the Prussian orders of the Red Eagle and of the Crown, the Austrian Order of the Iron Crown and the war medal of 1870. Dr. Rathenau was greatly interested in the safety movement, and in 1912 he donated to the American Museum of Safety a gold medal to be awarded annually for the best device or process for safeguarding human life in the electrical industry.

EMIL RATHENAU

Corporate and Financial

American Telephone & Telegraph Company.—The list of stockholders as of April 1, 1915, shows that the company has 62,000 shareholders, a number exceeded only by the Pennsylvania Railroad and the United States Steel Corporation. Over 60 per cent of the shareholders, holding above 50 per cent of the stock, live in Massachusetts. The Atlantic & Pacific Telephone & Telegraph Company reduced its holdings by 109,000 shares, practically all of which will be distributed ultimately among employees. The holdings of those having 10,000 shares and over, compared with their holdings twelve months previous, follow:

	April 1, 1915	April 1, 1914
Arthur A. Marsten et al., trustees for employees' stock	$103,000	.....
Bankers' Trust Company, New York, trustee	55,314	$53,948
Joseph J. Slocum, New York	20,400	20,400
Atlantic & Pacific Telephone & Telegraph Company	19,336	128,279
George F. Baker, New York	16,760	16,760
Frederick Ayer, Lowell, Mass	16,411	16,411
Zenas Crane, Dalton, Mass	15,323	18,323
Kidder, Peabody & Company, Boston, Mass	15,307	19,381
White, Weld & Company, New York	14,318	15,657
F. C. Welch et al., trustees, Boston	13,185	13,362
Winthrop A. Merrick, of J. P. Morgan & Company, New York	11,490	12,301
Eugene Higgins, New York	10,800	10,800
Richard Olney et al., trustees, Boston	10,120	10,800

Arizona Power Company, Prescott, Ariz.—An issue of $200,000 three-and-one-half-year 8 per cent collateral gold notes, due on Jan. 1, 1919, is offered at par and interest. The proceeds, with other available funds, will provide for the construction of a second hydroelectric plant to provide for growing business. The new plant will be erected above the present plant on Fossil Creek with an available head of about 490 ft. The energy generated at the new plant will be transmitted over existing lines, so that the new main line to be constructed will be limited to six miles, connecting the two plants. The cost of the new plant, including the connecting line, is estimated at $275,000, of which not exceeding $240,000 will be spent during 1915. The engineers expect to have the plant in operation early in 1916. The remaining $35,000 provided, together with an additional $45,000 for distributing-system extensions, will be expended during 1916.

Athens (Ohio) Electric Company.—The Public Utilities Commission of Ohio has authorized the issue of $75,000 common stock and $75,000 of 7 per cent notes payable on or before June, 1918. Of the common stock $50,000 is to be sold at not less than par. All of the notes and $25,000 of the stock are to be issued to Mr. Francke C. Elliott, trustee, in payment for a private electric-light plant in Athens, the acquisition of which by the Athens Electric Company was authorized in another order. The proceeds from the sale of the $50,000 stock are to be used for betterments.

Bradford (Ohio) & Gettysburg Electric Light & Power Company.—The Public Utilities Commission of Ohio has authorized the issue of $3,000 of first mortgage 5 per cent bonds and $5,000 of four-year 6 per cent promissory notes, both to be sold for not less than 90. The proceeds are to be used to reimburse the treasury for the construction of a transmission line.

Cambridge (Mass.) Electric Light Company.—At a meeting of shareholders on June 14 it was voted to increase the capital stock from $900,000 to $1,000,000 by issuing 1000 new shares at $200 each. Rights will accrue to shareholders of record on June 14.

Conococheague Electric Light, Heat & Power Company, Markes, Pa.—The company has sold its electric-light plant. It will be used by the McConnellsburg & Fort Loudon Railway as a generating station.

Consumers' Power Company, Mankato, Minn.—The city of Winnebago, Minn., has voted to sell its electric distributing system to a private company and has granted it a franchise therewith. This company will purchase its electrical energy from the Mankato division of the Consumers' Power Company.

Defiance (Ohio) Gas & Electric Company.—The Ohio Public Utilities Commission has authorized the issue of $97,600 of common stock and $175,000 of first mortgage 5 per cent gold bonds, of which $92,000, par value, are to be sold for not less than 80. Pending the sale of the $22,000 of the bonds, the company is authorized to pledge them as security for loans at not less than 80. All of the common stock authorized and $83,000 of the bonds are to be issued in full payment for the property of the Valley Light & Power Company. The proceeds from the sale of $70,000 bonds are to be used in payment for the property of the Auglaize Power Company. The proceeds from the sale of $22,000 bonds are to be used for betterments to the property formerly owned by the Valley Light & Power Company.

Detroit (Mich.) Edison Company.—An issue of $3,500,000 of 5 per cent first and refunding mortgage gold bonds is offered at 98½ and interest.

Idaho Railway, Light & Power Company, Boise, Idaho.—All the property, rights and franchises were sold on June 14 to the Electric Investment Company of New York, the purchasing corporation for the National Securities Corporation. The price bid was $4,542,750, the minimum allowed by the court.

Manchester (N. H.) Traction, Light & Power Company.—An issue of $1,000,000 three-year 5 per cent gold coupon notes due on June 1, 1918, has been sold at 97½ and interest to yield approximately 5.9 per cent.

Manila (P. I.) Electric Railroad & Lighting Corporation.—In submitting the annual report for the year ended Dec. 31, 1914, Mr. Charles M. Swift, the president, pointed out that during August heavy rains caused serious floods in Manila, and during September the city experienced the worst flood in its history. These caused the company to lose considerable revenue, and it was put to additional expense for repairs of track, roadway, rolling stock and power plant. The increase in expenses was due largely to the heavy gain in the number of electric customers, which necessitated an addition to the electric staff. This in itself created enlarged overhead expense, and the natural considerable increase in fuel consumption was emphasized by a larger average cost per ton of coal purchased. The rates for energy were reduced materially, and this is also reflected in receipts for 1914, so that while the number of customers increased by over 3300, total gross receipts showed a slight loss from the previous year. Business and financial conditions in the Philippine Islands during the year have been far from satisfactory. In the beginning of the year the world-wide depression began to be felt, and after the commencement of the European war the situation became gradually worse. The last five months of the year were the dullest period in the history of the company. The comparative statement follows:

	1914	1913
Gross earnings	$1,602,001	$1,698,593
Operating expenses and taxes	818,414	790,786
Net earnings	$783,587	$907,807
Fixed charges	277,717	277,617
Surplus	$505,870	$630,190

Northwestern Electric Company, Portland, Ore.—A mortgage for $10,000,000 has been filed in the office of the county auditor at Vancouver, Wash., given by the Northwestern Electric Company to the Harris Trust & Savings Bank of Chicago. All of the company's holdings in Clark, Cowlitz, Klickitat and Skamania Counties in Washington and Multnomah County in Oregon are given as security.

Pacific Gas & Electric Company, San Francisco, Cal.—Mr. Frank G. Dunn, the president, has sent the following statement to stockholders: "Under the terms of this company's general and refunding mortgage it is required to set aside each year a sum of money equivalent to 1 per cent of the entire amount of its outstanding funded debt and to apply this money to the redemption of bonds secured by this and various underlying mortgages. As the redemption of these bonds simply means that so much of the company's capitalization has been retired permanently, with a corresponding reduction in interest charges, it would be a proper and logical procedure to reimburse the treasury for these outlays through the sale of other securities. If this were done, the revenues so restored to the treasury, of course, would be available for general corporate purposes, including the payment of cash dividends on the common stock. It has seemed to your board, however, that such a course, even if practicable under

present conditions, would not be so conservative or so fair to all concerned as the method decided upon, of distributing directly to the stockholders the common stock issued in substitution for the retired interest-bearing obligations. The total amount of common stock which will be distributed in conformity with the above notice amounts to $1,926,600 and represents an equivalent amount of bonds retired with earnings, through the operation of sinking funds, since Jan. 1, 1914, and we wish to emphasize: (1) that practically $100 in cash has been paid in against each share of this stock, and (2) that the company's total outstanding capitalization will not be increased as a result of this distribution. It is the expectation of your board to continue similar distributions of common stock from year to year in addition to such cash dividends as the earnings of the company and general financial conditions may warrant. As the obligatory bond retirements are running at the rate of about 2.5 per cent per annum of the total amount of common stock outstanding, it is anticipated that the portion of such dividends which may be paid in common stock in future will be approximately at this rate. It has been the practice of your company for a number of years to set aside each year a portion of earnings as a reserve for depreciation. The amount to be so set aside this year will be $100,000 per month, or $1,200,000 for the year. We make this statement to remove any possible apprehension that the policy above outlined will disturb the present relation between assets and issued capital."

Pennsylvania Light & Power Company, Allegheny, Pa.—A summary of the income and profit and loss accounts for the year ended March 31, 1915, follows:

Gross earnings		$202,156
Operating expenses:		
Production	$72,507	
Distribution	17,168	
Customers	4,217	
Commercial	6,499	
General and miscellaneous	11,285	
Total operating expenses	$111,676	
Taxes	23,076	
Total operating expenses and taxes		134,752
Net earnings		$67,404
Other income:		
Rental of real estate and buildings	$1,763	
Interest and discount	7,255	
Total other income		9,018
Total income		$76,422
Deductions from income:		
Interest and discount	$1,032	
Miscellaneous	1,424	
Total deductions from income		2,456
Net income before deducting fixed charge		$73,966
Fixed charge—Interest on funded debt		8,766
Net income after deducting fixed charge		$65,190
Other deductions:		
Depreciation of property	$70,000	
Improvements and betterments, written off	3,096	
Total other deductions		73,096
Deficit for the year		$7,906
Surplus, April 1, 1914		194,864
Surplus March 31, 1915—per balance sheet		$186,958

Sandusky (Ohio) Gas & Electric Company.—The Public Utilities Commission of Ohio has authorized the company, pending the sale of $250,000 first refunding and mortgage bonds, to pledge $191,000 of these bonds as security for loans, which shall be of the largest amounts negotiable but not less than 78.5 per cent of the par value thereof. The money secured is to be devoted to additions, extensions and improvements in the sum of $109,820, and the remainder to be paid into the treasury in partial reimbursement for money spent for betterments during 1913 and 1914. Previously the commission had authorized the company to sell $250,000 of the bonds at not less than 87.5.

San Joaquin Light & Power Company, Fresno, Cal.—A meeting of stockholders has been called for July 19 to vote on a proposition to issue $954,000 of notes as a precautionary measure. The company has an issue of the same amount due on Aug. 1 and is endeavoring to sell sufficient 6 per cent series C bonds to meet the notes. If enough are not sold, then it is proposed to have the new note issue ready with which to take up any part of the old note issue that is covered by bond sales.

Southern Utilities Company, Jacksonville, Fla.—The first annual report states that during the early part of the season for the last two years Florida has experienced abnormally cold and wet weather which affected tourist travel and resulted in a loss of revenue. Citrus fruit growers were, owing to the European war in the latter part of the year, unable to make the ordinary shipments of fruit, in many instances allowing it to rot on the ground, which affected the company's car-icing business very materially. During 1913 and 1914 there was expended for additions, improvements and betterments $525,189. The company began operations in April, 1913. Comparative results follow:

	Twelve Months Ended March 31, 1915	March 31, 1914
Gross earnings	$1,068,531	$938,719
Operating expenses and taxes	778,032	707,884
Net earnings	$290,499	$230,835
Underlying charges	3,494	4,694
Balance	$287,005	$226,141
Bond interest	54,412	51,150
Balance	$232,593	$174,991
Other interest	39,082	16,586
Discount on one-year 6 per cent notes	2,500	.....
Balance	$191,011	$158,405
Preferred stock dividend	105,525	103,687
Surplus (applicable to common stock dividends and replacements and renewals)	$85,486	$54,718

Springfield (Ohio) Light, Heat & Power Company.—An issue of $300,000 of general and refunding mortgage 5 per cent bonds, due on April 1, 1933, is offered at 92.5 and interest.

Tulare (Cal.) County Power Company.—The stockholders voted on June 16 to sell the system to the Mount Whitney Power & Electric Company, which operates in the same territory, for $610,000, of which $550,000 will be in cash. The Tulare Power Company refused to sell to the Mount Whitney company a few weeks ago. The business of the Tulare County Power Company will be turned over to the Mount Whitney company on Aug. 3, when that company will pay at least $250,000 of the purchase price; the balance will be paid under an agreement not yet closed by directors of the companies. The stockholders will receive about $280,000 after the indebtedness is paid. The holders of preferred stock will receive back dividends at the rate of 7 per cent from the time the stock was issued. This will average about $20 per share, there being 2100 shares outstanding at present. The balance of the money will be divided equally between the holders of preferred and consumers' stock. There are 1700 shares of consumers' stock outstanding. The Mount Whitney company is one of the oldest power companies in the State and recently passed into the control of the John Hays Hammond interests. Aside from the acquisition of the Tulare company's system extensive improvements are planned, which include the completion of plant No. 5 on the Kaweah River. The Tulare company was composed largely of ranchers, and the energy generated was used principally for pumping plants on the east side of Tulare County and for light and power at Lindsay, Tulare, Porterville and Visalia.

Washington Water Power Company, Spokane, Wash.—On page 1656 in these columns, on June 19, there appeared an item in which it was stated that the property of the above company is to be offered at public sale. The statement as published was wholly inaccurate, the property for sale being that of a different company having a somewhat similar name. The facts are that no such proceedings are contemplated as the financial standing of the Washington Water Power Company is of the very best.

Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.—At meetings of stockholders of the Westinghouse Electric & Manufacturing Company and the Westinghouse Machine Company held on June 9 the following directors were elected: Westinghouse Electric & Manufacturing Company—Messrs. Edwin F. Atkins, Charles F. Becker and E. M. Herr, four years; John R. McCune and Jerome Hamauer, three years. Westinghouse Machine Company—Messrs. J. D. Callery, E. M. Herr, William McConway, John R. McCune, Joseph W. Marsh, L. A. Osborne, Guy E. Tripp and H. H. Westinghouse, one year.

Manufacturing and Industrial

The Northwestern Electric Company, 611 West Adams Street, Chicago, Ill., has opened an office at 401 Broome Street, New York.

Mr. James Ruddick, manager and engineer for the Stadacona Hydraulic Company, Quebec, will have his headquarters at Beaupré, Que.

The Good Housekeeping Electric Cooker Company of Berkeley, Cal., is the name of the concern formerly known as the Berkeley Electric Cooker Company.

The Condit Electrical Manufacturing Company, Boston, Mass., has changed the address of its office at Atlanta, Ga., from 1206 Empire Building to 481 Cherokee Avenue.

The Fort Wayne (Ind.) Engineering & Manufacturing Company has discontinued its agency at Seattle, Wash., the headquarters of which were in the Armour Building.

The Luminous Unit Company, St. Louis, Mo., has appointed the Childers & Waters Electrical Company of Louisville, Ky., distributer for its "Brascolite" fixtures in Kentucky.

James Beggs & Company, 36 Warren Street, New York, manufacturers of feed-water filters, grease extractors and sewage ejector systems, has opened offices in Saginaw, Mich., and Cleveland, Ohio.

The Watson-Davis Company, Leicester, Mass., has been organized to engage in general contracting for electric and water-supply installations and gasoline engines. Mr. O. W. Watson and Mr. F. E. Davis are organizers of the company.

The East Moline Electric Company, 814 Fifteenth Avenue, East Moline, Ill., has recently been formed and is engaged in the electrical contracting and supply business. Mr. R. C. Wood is president of the company, Mr. Edward Reavy secretary and manager, and Mr. L. M. Moss treasurer.

The New Era Spring & Specialty Company, 864 Woodward Avenue, Detroit, Mich., has closed its factory at Hempstead, L. I. The company has appointed Mr. H. P. Rhodes, formerly manager of the Cleveland Spring Company, Cleveland, Ohio, as its general traveling representative for Southern territory.

Mr. F. W. Schuster has resigned his position as advertising man with the Meadows Manufacturing Company, Pontiac, Ill., manufacturer of electric washing machines, with which he has been connected for the past five years. He will become identified in a similar position with the A. H. Anderson Printing Company, Streator, Ill.

The Frank Ridlon Company, Boston, Mass., a firm of electrical engineers and manufacturer and repairer of electrical apparatus, has moved its New York office to 114 Liberty Street. Mr. G. L. Smead will be manager of the vacuum-cleaner and fixture department, and Mr. Harry De Steese will be manager of the export and supply department.

Permanent Machinery Exhibit at Louisville, Ky.—One of the exhibits of machinery in the permanent exhibit which has been arranged for at Louisville will be that of the James Clarke, Jr., Electric Company of Louisville. Mr. Clark has been selected as a member of the bureau of manufacturers of the Commercial Club, which has organized the exhibit and which will supervise it.

Byllesby Properties Add Many "Hot-Point" Appliances.—The thirty Byllesby companies which co-operated in the "Hot-Point Week" sales campaign in conjunction with the dealers disposed of 1855 appliances. Of these, 910 were the new "El Grilstovos," 773 were electric flatirons, and 172 were miscellaneous appliances. These appliances represent an addition of 903 kw to the lines of the Byllesby companies.

Company to Place Electric Motorcycle on Market Next Spring.—An electric motorcycle, or "electrocycle," as it is called, to be operated by a 1.5-hp motor, will be placed on the market, it is announced, by the Hill-Standard Manufacturing Company of Anderson, Ind., next spring. It is planned to develop a machine weighing about 120 lb., which will be equipped with a storage battery designed to provide energy for a run of 100 miles.

The Conduit-Miller Company, 440 South Warren Street, Syracuse, N. Y., has recently been formed and represents the consolidation of the Conduit Electric Company and the Miller Electric Fixture Company. The company is engaged in contracting work and the repair of motors. It is also working on the development of the Myers break-finder. Mr. H. M. Smith is president of the company, Mr. I. D. Perry secretary, and Mr. M. H. Salmon treasurer.

Power-Plant Improvement at Fargo, N. D.—Work has been started under the direction of the engineering department of H. M. Byllesby & Company on the reconstruction of the power house of the Union Light, Heat & Power Company at Fargo, N. D. In the boiler room two new 350-hp boilers with automatic stokers will be added and two 1500-kw steam turbines will be installed in the engine room. It is expected that the improvements will be completed in time to care for the peak load of the coming winter.

Demand for Swedish Ball Bearings.—The S. K. F. Ball Bearing Company has doubled its office space in the Hudson Terminal Building, 50 Church Street, New York, on account of the large increase in its business during the past four months. The company now has a full wing on the sixth floor of the building. The S. K. F. company claims that it is the only concern importing ball bearings from Europe that has not been interfered with by the war. It is receiving large shipments of bearings from Gothenburg, Sweden, via Norway and Denmark.

Increasing Use of Electric Fans in Motion-Picture Theaters.—The demand for electric fans for motion-picture shows this season promises to be large. In many cities new theaters are being constructed, and in these as well as a number of the old establishments elaborate fan "cooling" systems are being installed. In Louisville, Ky., it is reported that ten new motion-picture houses have recently been opened, and that all available second-hand fans in the film supply houses and exchanges have been taken; as a result there is a large demand for new fan equipment.

The Shawinigan Electro Products Company, with offices in the United States Fidelity & Guarantee Building, Baltimore, Md., and works at Highland Town, Md., has recently been organized and is engaged in the manufacture of ferro-silicon and other electric-furnace products. Mr. Charles E. F. Clarke, president of the Pennsylvania Water & Power Company, Holtwood, Pa., is president of the company; Mr. J. A. Walls, vice-president and chief engineer of the Pennsylvania Water & Power Company, is vice-president, and Mr. J. L. Rintoul, secretary and treasurer of the Pennsylvania Water & Power Company, is secretary and treasurer. The company will install electric furnaces of 10,000-kw rating.

New Building for Speer Carbon Company.—The Speer Carbon Company, St. Mary's, Pa., which has heretofore confined itself almost exclusively to the manufacture of brushes, has commenced making projector carbons. The company is building a new steel and glass factory, 150 ft. by 60 ft., to facilitate the manufacture of the new product. The building will be fireproof throughout, and the floor space will be entirely free from columns or roof supports. The walls of the longitudinal sides of the building will be of glass, mounted in steel sash, and the sides of a cupola running midway to the roof for its entire length will be of similar construction. The manufacturer claims that the new plant will have an output of 25,000 projector carbons a day. The electrical equipment will include a 25-kw motor for driving the pulverizer, a 10-kw motor to operate the crusher, two 10-kw motors for operating the mixers, two 5-kw motors to operate two group drives of carborundum wheels, besides various smaller motors for conveyors, elevators, etc. Energy will be obtained from the St. Mary's Electric Light Company. It is expected that the new plant will be in operation July 20.

General Electric Company Grants Vacation with Pay to Factory Workers.—Mr. G. E. Emmons, general manager, has announced that employees of the General Electric Company, Schenectady, N. Y., who have been in the company's service for ten years or more, and who are not now receiving vacations, will be granted one week's vacation with pay during the present year. Heretofore

only office employees and heads of departments have received vacations, but about 5000 factory employees will be affected by the new order. The official notice is as follows: "In recognition of the long and faithful service of those employees who on July 1, 1915, shall have served the company consecutively for ten years or over, the directors of the General Electric Company have voted that all such employees not now receiving a vacation shall be granted one week's vacation with pay during the present year. Those working by the hour will be paid full time at the hourly rate, and those working by the piece will be paid a full week's average earnings under normal conditions. If desired, paymaster will, upon application, pay vacation money in advance."

Orders for Electrical Apparatus. — The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has recently received orders for the following apparatus: The Johnstown (Pa.) Traction Company, one 300-kw rotary converter, one 300-kva transformer and one two-panel switchboard; the Toledo (Ohio) Railway & Light Company, one 1500-kw rotary converter and three 500-kva transformers; the city of Cleveland, Ohio, two 1000-kw rotary converters, six 365-kva transformers and one twelve-panel switchboard; the Philadelphia (Pa.) Suburban Gas & Electric Company, one 500-kw rotary converter and three 110-kva transformers; the Metropolitan Street Railway Company, Kansas City, Mo., one 3000-kw rotary converter, three 1000-kva transformers, one blower outfit for the transformers and a three-panel switchboard; the Commonwealth Edison Company, Chicago, Ill., one 4000-kw rotary converter, one 4200-kva transformer and one switchboard; the Pittsburgh (Pa.) Railway Company, four 1800-kw rotary converters, twelve 625-kva transformers, one thirty-three-panel switchboard and three 1000-kw motor-generator sets; the St. Louis, Rocky Mountain & Pacific Company, Raton, N. M., one portable substation consisting of a 300-kw motor-generator set, three 100-kva outdoor transformers and one two-panel switchboard; the Sioux City (Ia.) Gas & Electric Company, one 35-kw, 125-volt direct-current generator with reduction gear and turbine; the Bowery Y. M. C. A., New York City (Geo. A. Fuller Company), one 50-kw, 125-250-volt direct-current, three-wire generator and two 35-kw, 125-250-volt direct-current, three-wire compound-wound generators; the Buffalo (N. Y.) General Hospital, one 75-kw, 125-volt commutating-pole generator; the Linz Realty Company, Dallas, Tex., one 70-kw generator and one switchboard panel; the Mercer Iron & Coal Company, two 200-kw rotary converters with transformers and switchboard; the Westmoreland Coal Company, Pittsburgh, Pa., one 600-kva turbine unit; the New Run Company, Macdonald, W. Va., two 150-kw synchronous motor-generator sets; the Lackawanna Coal & Coke Company, Wehrum, Pa., one 600-kva turbine unit; the Clinchfield Coal Corporation, two 200-kw synchronous motor-generator sets, and the Alabama Fuel & Iron Company, one 300-hp hoist motor and liquid control.

NEW YORK METAL MARKET PRICES

	June 15 — Selling Prices Bid	Asked	June 22 — Selling Prices Bid	Asked
Copper	£ s d		£ s d	
London, standard spot*	86 5 0		82 15 0	
Prime Lake	20.37½	to 20.62½	20.00	to 20.50
Electrolytic	20.25	to 20.50	19.75	to 20.00
Casting	19.25	to 19.37½	18.87½	to 19.12½
Copper wire base	21.50	to 22.00†	21.50	to 22.00†
Lead	7.00		5.75	
Nickel	45.00	to 48.00	50.00†	
Sheet zinc, f.o.b. smelter	30.00†		30.00†	
Spelter	22.00	to 22.50†	18.00	to 18.50†
Straits tin	42.50†		41.30†	
Aluminum, 98 to 99 per cent.	28.00	to 30.00	31.00	to 33.00

*OLD METALS

Heavy copper and wire	18.75	18.75
Brass, heavy	15.00	15.00
Brass, light	11.50	11.50
Lead, heavy	6.62½	5.00
Zinc, scrap	17.00	14.50

*COPPER EXPORTS

Total tons to June 22	5,586

*From daily transactions on the New York Metal Exchange.
†Nominal.

New Incorporations

The Morton's Gap Ice & Light Company, of Morton's Gap, Ky., has been chartered with a capital stock of $10,000 by W. W. Kingston and others.

The Smith's Grove Light & Ice Company, of Smith's Grove, Ky., has been incorporated with a captial stock of $5,000 by J. C. Edwards, J. T. Smith and Edgar Beeler.

The Buffalo Light Company, of Buffalo, Okla., has been granted a charter with a capital stock of $10,000. The incorporators are D. G. Rogers of Buffalo, S. N. Rogers and M. K. Rogers of Doby Springs.

The Galveston Light & Power Company, of Galveston, Ind., has been incorporated by W. H. Arnold, W. H. Arnett and others. The company is capitalized at $10,000 and purposes to furnish light and power in Galveston.

The Central Service Company, of El Campo, Tex., has been chartered with a capital stock of $200,000 to manufacture ice and to generate and distribute electricity for lamps and motors. The incorporators are F. J. Hardey, W. J. Hefner, E. L. Correll and others.

The Southwick Electric Company, of Southwick, Mass., has been incorporated with a capital stock of $6,000 for the purpose of constructing and operating an electric-lighting plant in Southwick. The officers are: Ray M. Fletcher, president; William F. Fletcher, vice-president, and Frank Gladwin, treasurer.

The Municipal Lighting Company, of Mount Kisco, N. Y., has been incorporated with a capital stock of $100,000 to generate and distribute gas and electricity; also to deal in fixtures, stoves, etc., manufacture coal tar and deal in coal. The incorporators are W. G. Hoyt, of Garden City; J. E. Sanborn, of New Rochelle, and W. C. Phelps, of Mount Vernon.

The Northwestern Ohio Light Company, of Van Wert, Ohio, has been incorporated with a capital stock of $10,000 by William Hurd, of Urbana; C. A. Radcliffe, J. H. and U. S. Brant, all of Columbus, and Lindsey Hooper, of Boston, Mass. The company will take over and operate seventeen electric-light plants, the principal ones being at Urbana, Van Wert, Delphos, Ottawa, Leipsic and Deshler.

New Industrial Companies

The Dunlap Fountain Company, of Newark, N. J., has been chartered with a capital stock of $50,000 to manufacture electrical fountains. The incorporators are Charles A. Dunlap, Edward A. Bmoeder and W. Howard Demarest, all of Newark, N. J.

The Charles P. Taylor, Inc., of Newark, N. J., has filed articles of incorporation with a capital stock of $100,000 for the purpose of dealing in electric motors, dynamos, etc. The incorporators are Ralph H. Dixon, Aura M. Higbee and J. Fred Anderson.

The G. & E. Utility Corporation, of Syracuse, N. Y., has been incorporated by M. Dowd, B. N. Baldwin and R. I. Staten, 606 East Fayette Street, Syracuse, N. Y. The company is capitalized at $10,000 and purposes to deal in gas and electric fixtures and to do general repairing work.

Sultzer & Chambre, of New Rochelle, N. Y., has been incorporated with a capital stock of $5,000 by F. Chambre, W. F. and M. L. Sultzer, 64 Burlingame Lane, New Rochelle, N. Y. The company purposes to do a general electrical and architectural contracting and construction business.

Roeser & Heidelberger, of New York, N. Y., has filed articles of incorporation with a capital stock of $10,000 for the purpose of manufacturing and dealing in lighting fixtures and appliances. The incorporators are Charles Heidelberger and Christian Roeser, 203 West Seventy-eighth Street, New York, N. Y.

The Bruston Electric Lighting & Power Company, of New York, N. Y., has been incorporated with a capital stock of $100,000 to manufacture and deal in machinery and equipment for electric lighting and heating plants. The incorporators are J. L. Bissell, E. E. Emerson and D. H. Benton, 115 Broadway, New York, N. Y.

The Syracuse Electric Fixture Company, of Syracuse, N. Y., has been incorporated by W. P. Ray, G. R. Harriman and E. E. Levante, 309 Gertrude Street, Syracuse, N. Y. The company is capitalized at $5,000 and purposes to do a general electrical contracting business.

The Apex Electrical Specialty Company, of Newark, N. J., has been incorporated with a capital stock of $3,000 to manufacture toys, signs, etc. The incorporators are: Fred W. Bartlett, of Caldwell; Cyrus H. Vail, of East Orange, and W. Locke Rockwell, of Montclair, N. J.

The Central Station Equipment Company, of New York, N. Y., has been incorporated by J. Sarano, J. Landers and F. C. Joutras, 114 Liberty Street, New York, N. Y. The company is capitalized at $10,000 and purposes to do a general electrical contracting and construction business.

The Sterling Devices Company, of New York, N. Y., has been incorporated with a capital stock of $5,000 to manufacture and deal in gas fixtures, electroliers and engineering supplies. The incorporators are: F. H. Stokes, E. W. Smith and W. H. Brady, 559 West Twenty-sixth Street, New York, N. Y.

The R. B. Stanley Manufacturing Company, of New York, N. Y., has been chartered with a capital stock of $10,000 to manufacture and deal in motors, engines, machinery, etc The incorporators are Rolof D. Stanley, George B. Palmer and others. Ferguson & Ferguson, 41 Park Row, New York, N. Y., are attorneys.

Trade Publications

Desk Fans.—The Carleton Company, 170 Summer Street, Boston, Mass., is sending out a leaflet on its electrically operated desk fans.

Vacuum-Cleaning Machine.—The Kewanee (Ill.) Private Utilities Company has issued Bulletin P, which describes its vacuum-cleaning machines.

Electrification of Paper Mills.—V. D. Simons, 39 South La Salle Street, Chicago, Ill., has prepared Leaflet No. 4, on the electrification of paper mills.

Power Plant Apparatus.—F. A. Nusbaum, 219 Ruffner Street, Cincinnati, Ohio, has issued an illustrated catalog entitled "Power Plant Specialties."

Electric Fan.—The Mysto Manufacturing Company, New Haven, Conn., has prepared a folder which contains information on its "Polar Cub" fan.

Reflector Units.—The Electric Devices Company, Cleveland, Ohio, has issued several loose leaflets which describe its reflectors for nitrogen-filled lamps.

Boring Machine.—The Henderson Electric Company, Ampere, N. J., is sending out a card which describes and illustrates its collapsible boring machine.

Switches for Panelboard.—The Arrow Electric Company, Hartford, Conn., has prepared a leaflet which contains information on its small switches for panelboards.

Lacquer.—A folder which contains information on lacquer for armatures, field coils, dynamos and motors has been issued by the John C. Dolph Company, Newark, N. J.

Bell-Ringing Transformer.—The Pittsburgh Transformer Company, Pittsburgh, Pa., has issued a folder which contains information on its bell-ringing transformer.

Violet-Ray Generator.—The Sanax Company, 125 East Twenty-third Street, is sending out a card which contains information on the Sterling "violet-ray" generator.

Non-Glare Lens for Automobiles.—The Lancaster (Ohio) Lens Company has prepared a booklet which contains information on a non-glare lens for automobile headlamps.

Diesel Engines.—The Allis-Chalmers Manufacturing Company, Milwaukee, Wis., has issued Bulletin No. 1532, which contains information on oil engines of the Diesel type.

Electric Water Heater.—The Sterling Corporation, Cleveland, Ohio, has prepared a folder which describes and illustrates an electric water heater which can be attached to the water mains.

Vacation Kits.—A folder which suggests various electrical devices for use in a vacation kit has been issued by the Edison Electric Illuminating Company of Brooklyn, N. Y.

Guy Clamps.—W. N. Matthews & Brother, Inc., 3722 Forest Park Boulevard, St. Louis, Mo., are sending out an illustrated folder which contains information on their boltless guy clamps.

Automatic Fire-Alarm System.—The American Telephone Fire Alarm Company, 10 South La Salle Street, Chicago, Ill., has issued a folder which describes its thermopile fire-alarm apparatus.

Electric Iron with Lamp Attachment.—The Pittsburgh Electric Specialty Company, 927 French Street, Pittsburgh, Pa., has published a leaflet which describes its electric iron with lamp in handle.

Glass Frost.—Duhrssen & Pfaltz, Inc., 19 East Seventeenth Street, New York, are sending out a leaflet which contains information on material for frosting and etching lamps and glassware.

Shade Holders.—The Arrow Electric Company, Hartford, Conn., is sending out a folder which describes and illustrates a one-piece shadeholder which can be attached to brass-shell sockets and receptacles.

Gasoline-Engine-Driven Generating Sets.—The Okey Manufacturing Company, Columbus, Ohio, has issued Bulletin F-6, which describes its self-contained gasoline-engine-operated generating sets.

Speed-Reducing Gear.—The Turbo-Gear Company, Industrial Building, Baltimore, Md., has issued Catalog A, which describes a gear set for reducing the speed of electrically operated machines and turbines.

Electric Drink Mixer.—The Shelton Electric Company, Forty-second Street Building, New York, has prepared an illustrated leaflet which contains information on its recently developed drink-mixing machine.

Electric Shoe-Treeing Iron.—The Fern Company, Baltimore, Md., has issued an illustrated leaflet containing information on its electrically heated shoe-treeing iron, or "Calorel re-laster," as it is called.

Reinforced-Concrete Chimneys.—The Weber Chimney Company, 1452 McCormack Building, Chicago, Ill., has issued Catalog No. 10, which describes several installations of its reinforced-concrete chimneys.

Lighting Fixtures.—The Pettingell-Andrews Company, Pearl Street and Atlantic Avenue, Boston, Mass., has prepared a small booklet which lists and illustrates a number of different types of decorative lighting fixtures.

Electrical Instruments and Circuit-Breakers.—The Roller-Smith Company, 203 Broadway, New York, is sending out a number of loose leaflets which contain information on circuit-breakers and various types of electrical instruments.

Electrical Long-Distance Indicator.—The Kennedy telemetric gage or electrical long-distance indicator is described and illustrated in a catalog issued by the Connelly Iron Sponge & Governor Company, 127 Duane Street, New York.

Pressed-Steel Switch Boxes.—The Tregoning Electric Manufacturing Company, 422 West Prospect Avenue, Cleveland, Ohio, is sending out a leaflet which describes and illustrates pressed-steel switch boxes and a sign and box receptacle.

Gears.—The Falk Company, Milwaukee, Wis., has issued Bulletins Nos. 21 and 22 on turbine gear units, Bulletin No. 33 on gear units for motor drive, and a paper entitled "Herringbone Gears with Special Reference to the Wuest System," by Percy C. Day.

Gears, Pinions and Trolleys.—The R. D. Nuttall Company, McCandless Avenue and Harrison Street, Pittsburgh, Pa., has issued Catalog No. 12 on gears, pinions, trolley poles, etc., for mine and industrial haulage service, and Catalog No. 13 on gears, pinions, trolleys, steel trolley poles, etc., for electric-railway service.

Automobile Storage Battery.—The Electric Storage Battery Company, Philadelphia, Pa., is sending out a manual on its Exide batteries for automobile starting and lighting service. The company has also prepared a bulletin entitled "A Sure Start Assured," which contains information on batteries for automobile starting and lighting.

Construction News

New England

SEDGWICK, MAINE.—Work has begun on the construction of the power house for E. C. Cole in Sedgwick.

SORRENTO, MAINE.—The installation of an electric-lighting system in Sorrento is reported to be under consideration.

CENTER HARBOR, N. H.—The Meredith El. Lt. Co., of Meredith, has purchased the local electric light and power plant and will extend its lines to connect with the system here. Electricity for operating the system will be purchased from the Laconia Gas & El. Co., of Laconia. Contracts for the work have been awarded. A. H. Plaisted, superintendent of the Meredith company, has charge of the work.

BRANDON, VT.—The Hortonia Pwr. Co., of Brandon, has applied to the Public Service Commission for permission to increase its capital stock by $250,000 and to issue $600,000 in bonds. The company proposes to build a power plant in Hortonville.

CAMBRIDGE, MASS.—The stockholders of the Cambridge El. Lt. Co. have voted to increase the capital stock from $900,000 to $1,000,000; 1000 shares are to be issued at $200 each.

GARDNER, MASS.—An agreement has been reached between the Selectmen and the Gardner El. Lt. Co. for extending the street-lighting system. The present plans provide for the installation of 89 additional lamps to be erected in different parts of the town.

MANCHESTER, MASS.—The State Board of Gas and Electric Light Commissioners has authorized the Manchester El. Co. to increase its capital stock by $34,300, the proceeds to be used to pay for improvements made to its plant.

SOUTHWICK, MASS.—The Southwick El. Co., recently incorporated, has petitioned the State Board of Gas and Electric Light Commissioners for permission to issue $6,000 in capital stock, the proceeds to be used for the purpose of erecting a transmission line from the Westfield town line to Southwick to supply electricity here. The company has applied to the Selectmen for permission to erect poles and wires for distributing system. A special town meeting will soon be called to submit to the voters the proposal to enter into a contract with the company for street-lighting. Raymond M. Fletcher is president of the company.

STERLING JUNCTION, MASS.—The trustees of the Sterling Junction camp grounds have decided to have an electric-lighting system installed on the grounds.

CHARLESTON, R. I.—The Narragansett Pier El. Lt. & Pwr. Co., of Narragansett Pier, has applied to the Town Council for a franchise to erect transmission lines on the highways of the town.

STRATFORD SPRINGS, CONN.—The Borough Council has voted to accept the proposal of the Rockville-Willimantic Ltg. Co. for rearrangement of the lighting system, under the terms of which all arc lamps will be removed and eight 200-cp lamps will be installed on Main Street in addition to a number of 40-cp lamps.

Middle Atlantic

BROOKLYN, N. Y.—The Public Service Commission has awarded the contract for construction of Section No. 1 of the Nostrand Avenue subway in Brooklyn, which covers that part of the Eastern Parkway line extending from Eastern Parkway under Nostrand Avenue to Church Avenue, to the Newman & Carey Co., 215 Montague Street, Brooklyn, at $2,073,303.

BUFFALO, N. Y.—The Salmon River Pwr. Co., of Buffalo, has applied to the Public Service Commission for permission to issue $546,000 in bonds.

BUFFALO, N. Y.—Lansing, Bley & Lyman, architects, Prudential Building, Buffalo, it is reported, are receiving bids for the construction of power plant and service building for the Children's Hospital. Mrs. Bernard Barton, Bryant Street and Oakland Place, is superintendent.

CHELSEA, N. Y.—The Town Board has entered into a contract with the Garner Print Works & Bleachery, of Wappinger Falls (electrical department), for lighting the streets of the town. Orville M. Whitehouse, of Wappinger Falls, is superintendent.

COHOES, N. Y.—The Cohoes Co. has applied to the Public Service Commission for permission to erect electric transmission lines along the Erie Canal between the cities of Cohoes and Watervliet and in the village of Green Island, and for approval of franchises.

JAMESTOWN, N. Y.—The Western New York El. Co., of Jamestown, has applied to the Public Service Commission for permission to construct electric transmission lines in the town of Ellicott and for approval of franchise.

MANNSVILLE, N. Y.—Application has been made to the Public Service Commission by C. A. Keller for permission to construct an electric-lighting plant in Mannsville and for approval of a franchise in the village.

MIDDLETOWN, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until June 29 for additions and alterations to power house and power house equipment, construction, heating, plumbing and electric work at the Middletown State Hospital, Middletown. Drawings and specifications may be consulted at the Middletown State Hospital, at the New York office of the Department of Architecture, Room 1224 Woolworth Building, and at the Department of Architecture Capitol, Albany. E. S. Elwood is secretary of State Hospital Commission.

STOCKPORT, N. Y.—The Public Service Commission has granted the Albany Southern R. R. Co. of Hudson permission to erect transmission lines and exercise a franchise for the distribution of electricity for commercial purposes in the town of Stockport.

SYRACUSE, N. Y.—The Oswego River Pwr. Trans. Co., of Syracuse, has applied to the Public Service Commission for permission to operate and maintain an electric transmission line upon the state lands on the berme side of the Oswego Canal in the city of Fulton.

UTICA, N. Y.—The New York Central R. R. Co. has been granted a permit to build a brick signal tower and battery house on the west side of Meadow Street, to cost about $15,000, in connection with its signal and electric interlocking switching system.

ALLENTOWN, PA.—The Bayuk Brothers Co., of Philadelphia, cigar manufacturers, it is reported, has awarded a contract to William Linker & Co., of Philadelphia, for the construction of a large four-story building in Allentown. The factory, it is reported, will be equipped throughout with electrically driven machinery.

CANONSBURG, PA.—The contract of the West Penn Ltg. Co., of Washington, for furnishing electricity for lamps, heaters and motors in Canonsburg, has been approved by the Public Service Commission.

HARRISBURG, PA.—The contract for furnishing electrical supplies for the State was recently awarded to the Doubleday-Hill El. Co., of Pittsburgh.

JOHNSTOWN, PA.—Plans are being prepared for the construction of an electric railway from Johnstown to Rockwood. The cost of the proposed railway is estimated at about $1,000,000.

NEWPORT, PA.—Bids will be received by the Board of Commissioners of Newport Township until July 2 for installing a fire-alarm system in Newport Township. W. O. Davis, of Glenlyon, Pa., is secretary.

PITTSBURGH, PA.—The Public Service Commission has given its approval of a contract between the Duquesne Lt. Co., of Pittsburgh, and the borough of Mount Oliver for street-lighting.

SMETHPORT, PA.—The Borough Council has granted the Kane El. Lt. & Pwr. Co., of Kane, a franchise to extend its transmission line to Smethport to furnish electrical service here.

SUMMIT HILL, PA.—The Town Council has awarded a contract to the Panther Valley El. Lt. Co., of Lansford, to erect 40 electric lamps in the park.

HARRISON, N. J.—The Public Service Co. of New Jersey will replace its overhead wires on Fourth Street with an underground conduit system, at a cost of about $35,000.

BALTIMORE, MD.—The Pennsylvania R. R., it is reported, will make extensive improvements to its freight yards in Baltimore, involving an expenditure of over $1,000,000. The work will include improvements to its facilities for handling coal, concrete bulkhead pier, machinery for loading coal into vessels, coal dumper, thawing house, etc.

BALTIMORE, MD.—Bids will be received by the Board of Awards, of Baltimore City, at the office of the city register, City Hall, Baltimore, until June 30, for furnishing and erecting a 20,000,000-gal. centrifugal pump and electric power equipment for the Eastern pumping station, Water Department, as follows: Three 250-kva transformers, circuit-breakers and high-tension switchboard, one two-panel low-tension switchboard, all wiring and starter for connecting up 800-hp motor; one 800-hp motor and one 25-hp motor and starter and one 20,000,000-gal. centrifugal pump (daily capacity). Plans and specifications may be obtained at the office of the water engineer, City Hall, Baltimore, upon deposit of $5. Robert L. Clemmitt is acting water engineer.

LONACONING, MD.—The Council has granted the Edison El. Illg. Co., of Cumberland, a franchise to erect transmission lines through the town. The company is extending its transmission line to the property of the Maryland Coal Co. to furnish energy for lamps and motors.

BLUEFIELD, W. VA.—We are informed that the city of Bluefield does not contemplate the installation of a municipal electric-lighting plant as reported in the issue of June 12. The Appalachian Pwr. Co., of Bluefield, supplies electrical service in Bluefield. R. L. McLellan is manager of the company.

NORTON, VA.—The Norton Coal Co. is reported to be contemplating rebuilding its power house, which was recently destroyed by fire, causing a loss of $25,000.

WASHINGTON, D. C.—Bids will be received at the office of the Commissioners of the District of Columbia, Room 509, District Building, Washington, D. C., until June 28 for furnishing one X-ray machine and accessory equipment for use in the Washington Asylum Hospital. Specifications and form of proposal may be obtained from the purchasing officer, Room 320, District Building.

WASHINGTON, D. C.—Bids will be received at the office of the secretary of the Board of Commissioners of the District of Columbia, District Building, Washington, D. C., until June 30 for the superstructure, heating, plumbing, electrical work and radial brick stack of High School No. 174. Blank forms of proposals, specifications, etc., may be obtained from the chief clerk of the engineer department, Room 427, District Building.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until July 6 for furnishing supplies as follows: Brooklyn, N. Y., Schedule 8481—2000 ft. controller cable for electric control searchlights, 25,000 ft. braided antenna wire; Schedule 8479—miscellaneous running lamps for motor boats, 40 side lamps; Schedule 8487—miscellaneous steel tubing, miscellaneous gate valves. Bids will also be received at the same place until July 20 for the following supplies: Mare Island, Cal., Schedule 8498—two 30-in. searchlights and two double-face telegraph transmitters. Application for proposals should designate the schedule desired by number.

WASHINGTON, D. C.—Foreign trade opportunities are announced by the Bureau of Foreign and Domestic Commerce in the Commerce Reports as follows: No. 17,150—An American consular officer in Spain reports that by royal decree the Minister of the Navy in Spain has been authorized to erect a wireless station and to purchase six motor boats. No. 17,156—A business man in Spain informs an American consular officer that he desires to communicate with American manufacturers of metal connections and fixtures for electric-light bulbs. No. 17,169—An American consular officer in Spain reports that a business man in his district desires to communicate with American manufacturers of files, twist drills, die stocks and all kinds of electrical supplies. The man desires to act on an agency basis only. No. 17,171—One of the commercial agents of the Bureau of Foreign and Domestic Commerce in Costa Rica reports that an electrical power plant in that country is preparing to expend about $250,000 in extension of its lines. The company will need generators, turbines, switchboards, switches, insulators, insulated wire, arc and incandescent lamps, and all fixtures, transformers, etc. Correspondence may be in English. No. 17,182—A representative of a commission firm in Colombia is in New York City and desires to secure agencies for the following goods: Portland cement, gasoline, oil, electrical appliances, agricultural machinery, automobiles, etc. No. 17,187—A business man in Spain informs an American consular officer that he wishes to import machinery for making concrete bricks; also air-compressor pumps and cheap motor pumps. It is stated that the "Krystal" type, which sells for about $80 c.i.f. destination, is desired. Correspondence should be in German. No. 17,079—An American consular officer in Uruguay reports that a taxicab company in Uruguay desires to represent American manufacturers of automobile tires and electrical accessories for motor cars. Correspondence should be in Spanish or French. Further information may be obtained at the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., or its branches.

North Central

ADRIAN, MICH.—The City Commission has awarded the Citizens' Lt. & Pwr. Co. of Adrian a contract to light the streets of the city outside of the down-town and Tecumseh Street ornamental lighting districts.

CALUMET, MICH.—The Mohawk Mining Co., of Calumet, it is reported, is contemplating the construction of an electric plant.

DETROIT, MICH.—The Detroit Wire Spring Co. is planning to erect a factory building (80 ft. by 400 ft., two stories high). Bids will be taken later on heating and wiring. Kahn & Wilby, 58 Lafayette Boulevard, Detroit, are architects.

GRAND RAPIDS, MICH.—Preparations are being made by the South Division Center Improvement Association for the installation of an ornamental lighting system on Division Avenue, to cost approximately $18,886. The plans provide for 142 posts (luxulabra type, same as used in the main part of the town) to be maintained by underground wires. As yet no contracts have been awarded. The association expects to install a portion of these lamps during the summer. John F. Beck, 426 Thomas Street, S.E., Grand Rapids, is chairman of lighting committee.

LOWELL, MICH.—The Hydro-Electric Pwr. Co., of Lowell, it is reported, has engaged Wernette, Bradfield & Mead, architects, of Grand Rapids, to prepare plans for a number of changes to its plant.

BELLBROOK, OHIO.—The Village Council is negotiating with the Dayton Pwr. & Lt. Co. for furnishing electricity in Bellbrook and also for lighting the streets of the village.

CANTON, OHIO.—The Public Utilities Commission has authorized the Ohio Pwr Co., successor to the Sandusky River Pwr. Co., of Fremont, to issue $700,000 in bonds.

CLEVELAND, OHIO.—The contract for special lighting fixtures for the new city hall has been awarded to Edward F. Caldwell, 38 West Fifteenth Street, New York, N. Y., at $38,000.

CONNEAUT, OHIO.—The city of Conneaut will install two 250-hp or 300-hp horizontal water-tube boilers and mechanical stokers in the municipal electric-light plant and erect a new chimney during July and August. Benjamin Laubach is superintendent.

COSHOCTON, OHIO.—The County Commissioners have decided to replace the present arc lamps in and around the Court Square with cluster lamps.

TOLEDO, OHIO.—The Toledo Ry. & Lt. Co. has taken out a permit to erect an addition to its power plant, to cost $2,700.

FORT THOMAS, KY.—The city of Fort Thomas is considering granting a franchise for an electric-light plant. Proposals for same will be received by Winston J. Ross, secretary of City Council.

LEXINGTON, KY.—The Kentucky Utilities Co., of Lexington, expects to erect within the next two months two out-door substations, one with output of 200 kw and the other of 300 kw. Equipment and material for above has been purchased. Harry Reid is president.

AKRON, IND.—The Akron Lt., Ht. & Pwr. Co. expects to purchase within the next four months some incandescent lamps and posts. The company has increased its capital stock from $5,000 to $15,000. Karl B. Gast is secretary and general superintendent.

LA GRANGE, IND.—The Town Board is considering calling an election to submit to the voters the proposal to issue bonds for the installation of a municipal electric-light plant.

NEW ALBANY, IND.—We are informed that the United Gas & El. Co., of New Albany, will not make any extensions at the present time. Reported in the issue of June 12 to be contemplating extensions and improvements to its system. J. M. Merker is superintendent of electric department.

NOBLESVILLE, IND.—The Noblesville Ht., Lt. & Pwr. Co. expects to erect within the next 60 days an office building, to cost about $10,000. Material has already been purchased. John T. Kester is manager.

ALBANY, ILL.—An election will soon be called to vote on the proposal to issue bonds for the installation of a municipal electric-light and power plant. Electricity for operating the system will be secured from the plant of the Clinton Gas & El. Co., of Clinton. If the proposition to install the plant is carried, the Clinton company will erect a transmission line from its plant in Clinton to Albany, at a cost of about $12,000. The Meredosia Drainage District proposes to equip its pumping plant for electrical operation. Energy to operate the plant will be supplied by the Clinton company.

BUFFALO, ILL.—Within the next three months the Central Illinois El. Co., of Buffalo, expects to erect 8 miles of 4400-volt, three-phase transmission line; also to purchase material for complete distribution system in Argenta, Ill. George B. Conover is president.

ELGIN, ILL.—Plans have been prepared by James B. Dibelka, state architect, 130 North Fifth Avenue, Chicago, Ill., for a power house for the Elgin State Hospital.

MANITO, ILL.—Within the next thirty or sixty days the Electric Light Commission expects to purchase some desk fans, vacuum cleaners, washing machines, etc., but as yet nothing definite has been decided upon. William T. S. Beebe is superintendent.

MECHANICSBURG, ILL.—The Decatur Ry. & Lt. Co., of Decatur, it is reported, is extending its system to Mechanicsburg to furnish electrical service here.

SPRINGFIELD, ILL.—The Senate has passed the house bill appropriating $140,000 for the installation of a new power and heating plant for the State Capitol.

SPRINGFIELD, ILL.—Residents of Lincoln Avenue are planning to install an ornamental lighting system from Lawrence Avenue to Washington Park. The city will furnish electricity and maintain the system.

WAUKEGAN, ILL.—The Pub. Ser. Co. of Northern Illinois, of Chicago, is planning the installation of a 2500-kw frequency changer in its Waukegan station. J. L. Hecht, of Chicago, is mechanical engineer.

FOX LAKE, WIS.—The Village Board has awarded the Beaver Dam Lt. & Pwr. Co., of Beaver Dam, a contract for street lighting. The contract provides for 42 lamps of 250 cp and three 400-cp lamps.

LA CROSSE, WIS.—Plans have been completed by the Wisconsin-Minnesota Lt. & Pwr. Co. for the erection of a new power station and the rehabilitation of its central heating system in La Crosse, at a cost of about $210,000. The new station will be operated in conjunction with the plants of the company in Chippewa Falls, Eau Claire and Winona. Hydroelectric power will also be brought into La Crosse from the hydroelectric station at Chippewa Falls and Eau Claire.

WABENO, WIS.—The Wabeno Ltg. Co., recently incorporated with a capital stock of $5,000, is contemplating the installation of an electric-lighting plant to supply electrictly in Wabeno and also in Soperton, about 1 mile distant. G. W. Jones and H. C. Humphrey are interested in the project.

LAKEFIELD, MINN.—Bonds to the amount of $31,000 have been voted for the installation of an electric light and power plant.

MINNEAPOLIS, MINN.—Work has been started on the erection of a transmission line by the Minneapolis General El. Co., which will connect the towns of Osseo, Rockford, Deland, Watertown, St. Bonifacius and Waconia to its transmission system. This line, which will be 65 miles long, will be completed, it is expected, about Nov. 1, and at least one of the towns (Osseo) will be connected prior to that date.

OWATONNA, MINN.—Bids will be received by the State Board of Control, State Capitol Building, St. Paul, Minn., until June 29 for construction, including general contract work, heating and ventilating, plumbing and electrical work, of the power house at the State Public School, Owatonna. Plans and specifications may be obtained upon application to C. H. Johnston, architect, 715 Capital Bank Building, St. Paul. Copies of plans and specifications may be seen at the St. Paul and Minneapolis Builders' Exchanges, office of the Board of Control, and at the office of the superintendent of the State Public School, at Owatonna.

WARREN, MINN.—Plans are being considered to double the output of the municipal electric-lighting plant.

WINNEBAGO, MINN.—At an election held recently the citizens voted to sell the municipal distributing system to the Commonwealth Pwr. Co., of Mankato, for $10,000; also to give the company a franchise to supply electrical service in Winnebago. The company will begin work at once on the erection of a transmission line from Amboy to this town.

EMMETSBURG, IA.—Bids will be received at the office of T. F. Rutledge, secretary of the street-lighting committee, Emmetsburg, until July 9 for the installation of an electrolier street-lighting system in this city. For details see proposal columns.

ESTHERVILLE, IA.—The Western El. Tel. Co., it is reported, is planning extensive improvements to its system, to cost about $65,000, which will include a new telephone exchange, 14 blocks of underground cable, new lines, automatic telephones and new switchboard, etc.

KEOKUK, IA.—A company, recently organized, has purchased 100 acres of land in Keokuk and proposes to build a plant for the reduction of zinc and other metals from ores by a new process. A long-term contract, it is reported, has been made with the Mississippi River Pwr. Co., of Keokuk, for an ultimate supply of 20,000 hp of energy from its hydroelectric power plant. The initial development provides for 4000 hp.

NORTHWOOD, IA.—Bids will be received by the board of education of Northwood until July 12 for electric fixtures for High School and fan ventilating system in the four-room grade building. Plans and specifications may be secured from Alban & Lockhart, Endicott Building, St. Paul, Minn., upon deposit of $10. M. H. Kepler is the president of the board of education.

WOODWARD, IA.—Bids will be received until July 7 at the office of the Board of Control of State Institutions, Capitol Buildings, Des Moines, for furnishing material and construction of the following buildings for the State Colony for Epileptics to be erected at Woodward: (1) Medical group consisting of one two-story and nine one-story buildings; (2) power plant; (3) one radial brick smokestack, 175 ft. high with 7-ft.-top diameters; (4) one-story laundry building; (5) one-story storehouse. Plans and specifications are on file at the office of the state architect, Des Moines. Copies of the same may be obtained upon deposit of $25. Proudfoot, Bird & Rawson, Flynn Building, Des Moines, are consulting architects.

BOSWORTH, MO.—Henrici, Kent & Lowry, consulting engineers, Reserve Bank Building, Kansas City, Mo., have been engaged to take charge of the engineering work for the proposed electric-light plant in Bosworth.

CAPE GIRARDEAU, MO.—The Missouri Pub. Utilities Co., of Cape Girardeau, is planning to erect a transmission line from Charleston to East Prairie, a distance of 11 miles, to furnish electrical service; also to erect two step-up and two step-down transformer stations, equipped with two 20-kw, 13,200/220/110-volt and two 2300/13,200-volt transformers. The overhead-line material will include 400 chestnut poles and 33 miles of No. 6 hard-drawn bare copper wire. The company is also extending its 13,200-volt transmission line from Chaffee to Oran and Morley, a distance of 10 miles. This service will be supplied from the plant at Cape Girardeau. P. Ziegenfuss, 750 Railway Exchange Building, St. Louis, is purchasing agent; J. W. Sullencar has charge of the work.

CHILLICOTHE, MO.—Bids will be received by John A. Ryan, secretary of board of public works, Chillicothe, until July 15, for furnishing and installing equipment for the municipal electric-light plant as follows: One 375-kva, three-phase, 60-cycle, 2300-volt generator, directly connected to a steam engine or steam turbine, to operate condensing, with separate exciter switchboard panel and instruments, power-circuit panel, etc.; one 500-gal.-per-minute motor-driven centrifugal pump for use with condenser and one 12-in. barometric condenser; one 12-in. horizontal oil separator and miscellaneous pipe, valve fittings, etc. Plans and specifications are on file in the office of the Board of Public Works, Chillicothe, or may be obtained at the office of Harper & Stiles, Grand Avenue Temple, Kansas City, Mo., upon payment of $2.

HANNIBAL, MO.—The Hannibal Ry. & El. Co. has applied to the county court of Rall County for permission to erect a transmission line through Rall County to the line of Marion to secure energy from the transmission system of the Keokuk El. Co., of Keokuk, Ia.

KEYESVILLE, MO.—Henrici, Kent & Lowry, consulting engineers, Reserve Bank Building, Kansas City, Mo., have been engaged to prepare plans for the proposed electric-light plant in Keyesville.

LOWRY CITY, MO.—Henry S. Grimes is seeking a franchise for the installation of an electric-light plant in Lowry City.

MARYVILLE, MO.—The Maryville Lt. & Pwr. Co. has submitted a proposal to the Conception Junction Council offering to extend its transmission line to that town to furnish electrical service there. If the offer is accepted the company proposes to supply electricity to farmers residing along the route.

MONTROSE, MO.—The general contract for the construction of the municipal electric-light plant in Montrose is reported to have been awarded to the Matthews Construction Co.

POLO, MO.—The City Council has granted the Excelsior Springs Wtr., Gas & El. Co., of Excelsior Springs, a franchise to supply electricity in Polo.

SPRINGFIELD, MO.—The owners of the new Heer-Andrews Block have entered into a contract with the Springfield Gas & El. Co. to furnish electricity for the department store. An item published some time ago stated that the company would install its own power plant.

SPRINGFIELD, MO.—Local architects and contractors have been asked to prepare plans and estimates for the construction of a central lighting and heating plant to serve the business portion of the city. Many of the contracts of the larger buildings with the Springfield Gas & El. Co. and the Central Htg. Co. are about to expire, and if the cost is not too great, the plant will be built this summer. John T. Woodruff, of Springfield, is reported interested in the project.

TARKIO, MO.—Within the next six months the Tarkio El. & Wtr. Co. expects to purchase material for 6 or 8 miles of transmission lines and equipment for a small plant. W. F. Marshall is manager.

BROKEN BOW, NEB.—Preparations are being made by the city of Broken Bow for the installation of a municipal electric-light plant, to cost about $16,000. The present plans provide for one 100-hp boiler, one 75-hp engine to be directly connected to one 50-kw, three-phase, 60-cycle, 2300-volt generator, switchboard equipment, consisting of one generator panel, one street-lamp panel and two 10-kw series regulator, one 5-kw and one 1-kw transformer, and about 230 tungsten lamps of 100 cp. Contracts for construction of plant will be awarded about July 1. Charles F. Sturtevant, of Holdredge, is engineer in charge.

DAVENPORT, NEB.—Contracts for construction of substation, pole-line and substation equipment will be awarded July 1. The cost of the proposed work is estimated at about $5,000. Energy for operating the system will be obtained from the hydro-electric power plant owned by E. Meyer at Oak, Neb. (10 miles distant). Mr. Meyer was recently granted a 25-year franchise. The step-down transformers and lines in the town will be furnished by the municipality. Charles F. Sturtevant, of Holdrege, is engineer.

HASTINGS, NEB.—An additional 750-kw turbo-generator with jet condenser will soon be installed in the municipal electric-light plant. W. S. Watson is commissioner of water, light and sewer departments.

BURLINGTON, KAN.—The Excelsior Milling Co., of Burlington, is reported to be contemplating the installation of a hydro-electric power plant on the Neosho River.

EMPORIA, KAN.—Bids will be received by Charles W. Cleaver, secretary of the board of control of the Masonic fraternity, Emporia, until July 12 for construction of an addition (50 ft. by 75 ft.) to the Masonic Temple and for remodeling the present Masonic Temple in accordance with plans and specifications on file in the office of the secretary, Masonic Building, and also the office of C. W. Squires, architect, Emporia. Separate bids will be received at the same time for heating, plumbing, electric wiring and electric passenger elevator. Applications for plans must be accompanied by check of $25, to be refunded upon their return.

GAYLORD, KAN.—Bids will be received by the city clerk, Gaylord, until June 30 for furnishing material and construction of a municipal electric-light plant, separate bids to be submitted as follows: (1) Material for transmission lines in city and station equipment, except poles; (2) material (not named in list) and labor for erection of station equipment and everything connected with transmission line in the city; (3) material, except poles, for a 10-mile transmission line to Portis; (4) erecting transmission line from Gaylord to Portis and furnishing material not named in list of material. Plans and specifications are on file with the city clerk and at the office of George P. Taylor, engineer, Stockton, Kan.

McPHERSON, KAN.—The city of McPherson expects to purchase for the municipal electric-light plant supplies as follows: Recorders and flow meters, poles, cross-arms, etc., for rebuilding the distribution system; also to install a number of electric ranges in connection with the 4-cent rate. Will also remodel the pumping equipment, thoroughly overhaul, rebore, etc., all engines. Arthur Groesbeck is superintendent.

OSAWATOMIE, KAN.—Within the next two months the city of Osawatomie expects to build an addition to the power house of the municipal electric-light plant. Equipment, consisting of one 125-hp engine and 125-kw generator, has been purchased.

Southern States

CLARKSVILLE, TENN.—Owing to the unsatisfactory service given by the local company, the Chamber of Commerce is considering the organization of a company to operate an electric-light plant and also the installation of a municipal electric-lighting plant.

BIRMINGHAM, ALA.—W. W. Shortridge and associates are reported to have submitted a proposal to the Board of Revenue for a franchise to construct an electric railway (double track) from the city of Birmingham to some selected point on Warrior River.

LONOKE, ARK.—Within the next 30 days W. Y. Bransford, owner of the Lonoke light and water plant, expects to purchase one 50-kw, single-phase, 60-cycle, 1100/2200-volt generating unit (directly connected).

BOSWELL, OKLA.—The town of Boswell is considering the installation of a municipal electric-lighting system, to cost about $14,000.

LAVERNE, OKLA.—W. H. Lewis & Son, it is reported, are contemplating the installation of an electric-light plant in Laverne.

MARSHALL, TEX.—The Marshall El. Co. is contemplating the erection of a high-tension transmission line from Marshall to Jefferson.

RULE, TEX.—The Board of Local Improvements is considering the installation of an electric-lighting plant in Rule, to cost about $10,000.

Pacific States

HOQUIAM, WASH.—At an election held recently the proposal to grant George H. Tilden, of Seattle, a franchise to furnish electricity in Albion was defeated.

MONTESANO, WASH.—Bonds to the amount of $500,000 have been issued by the Northwest El. & Wtr. Wks. Co., of Montesano. Part of the proceeds will be used for extensions and improvements to its system in Montesano. The company is now building a new power plant on the Chehalis River.

MORTON, WASH.—Application has been made to the County Commissioners by C. O. Smith, proprietor of the Morton El. Co., for a franchise to erect transmission lines over certain county roads leading from Morton.

OLYMPIA, WASH.—Bids will be received by W. A. Hoage, city clerk, Olympia, until July 7 for furnishing electrical power to the city of Olympia. The party securing the contract must agree to furnish the service by Oct. 1, 1915. Plans and specifications are on file in the office of the city clerk.

PORT TOWNSEND, WASH.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 21 for the installation of an electric passenger elevator in the United States marine hospital at Port Townsend, Wash. For details see proposal columns.

SEATTLE, WASH.—The King County Commissioners, it is reported, have awarded the contract for installing electrical fixtures in the new county court house, under construction, to the Cascade Fixture Co., of Seattle, at $25,000.

OREGON CITY, ORE.—The City Council and business men on Main Street have reached an agreement whereby an ornamental lighting system (cluster lamps) will be installed the entire length of that thoroughfare.

SCIO, ORE.—Residents of Jordan and Bilyeu Den are considering the feasibility of damming Thomas Creek in the vicinity of Jordan for the purpose of installing a power plant.

BODIE, CAL.—Preliminary work has begun for the new power plant of the Pacific Pwr. Co., of Bodie, at Silver Lake.

SAN FRANCISCO, CAL.—The Board of Works, it is reported, has called for bids for lighting fixtures (to cost approximately $60,000) for the new City Hall.

VALLEJO, CAL.—Within the next two months the Vallejo El. Lt. & Pwr. Co. expects to erect 2 miles of pole line and to purchase material for same. A. Casper is manager.

VISALIA, CAL.—The Mount Whitney Pwr. & El. Co., of Visalia, is reported to be considering the construction of a hydro-electric power plant (to cost approximately $750,000) in the Sequoia National Forest.

ALBION, IDAHO.—The City Council has granted the Washington Wtr. Pwr. Co., of Spokane, Wash., a franchise to supply electricity in Albion for lamps and motors.

BLACKFOOT, IDAHO.—The Council is considering an offer submitted by M. E. Hughes, superintendent of the Southern Idaho Wtr. Pwr. Co., for the installation of a new street-lighting system in Blackfoot.

SODA SPRINGS, IDAHO—At an election held recently bonds to the amount of $15,000 were voted for the installation of a municipal electric-lighting plant.

TWIN FALLS, IDAHO.—Within the next two months the Great Shoshone & Twin Falls Wtr. & Pwr. Co., of Twin Falls, expects to purchase one 12-kw tub transformer, 50 center spans and 50 series tungsten lamps; also within the next 30 days to purchase 60 General Electric (type S) ranges, 25 Westinghouse, Copeman, 2-18 and 3-18, ranges. R. B. King is superintendent.

ANACONDA, MONT.—Contracts have been awarded for the ornamental lighting system to cost about $6,000. The plans provide for the installation of 60 lamp standards, carrying three-lamp clusters, two 80-cp and one 100-cp, maintained by underground wires. W. B. Vestal, Jr., is engineer.

DILLON, MONT.—The city of Dillon is contemplating the installation of a new street-lighting system. Single lamps and three-lamp clusters will be used. William E. Chapman is city engineer.

HELENA, MONT.—The City Council is considering the installation or a lighting system in lighting district No. 81, to cost about $20,000.

CONEJOS, COL.—The Conejos Co-operative Roller Mills & Mfg. Co., of Conejos, expects to purchase within the next two months one water-storage tank and some wiring supplies. James B. Neff is vice-president.

ESTES PARK, COL.—Plans are being considered by H. C. Bradley and C. C. Patrick, owners of Horseshoe Inn, in Estes Park, for the installation of an electric power plant (to cost about $8,000), to supply electricity for lighting the hotel and private residences. It is proposed to develop the water-power of Fall River to operate the plant.

Canada

HAMILTON, ONT.—The Hamilton Hydro-Electric Department contemplates improvements to the system, involving an expenditure of about $240,000.

PETERBORO, ONT.—The city of Peterboro is contemplating the construction of a new substation, to cost about $50,000.

SARNIA, ONT.—As a result of a report submitted by Engineer Jaffrey of the Hydro-Electric Power Commission of Ontario, the City Council will offer the Sarnia Gas & El. Co. the sum of $155,000 for its plant and equipment, with the view of installing Niagara power. If the offer is accepted by the company a by-law authorizing a contract with the Hydro-Electric Power Commission will probably be submitted to the ratepayers soon.

TORONTO, ONT.—Plans are being prepared by the Hydro-Electric Power Commission of Ontario for erection of transmission lines to connect 17 more municipalities with the Hydro-Electric system. It is also stated that 14 other municipalities are considering entering into contracts with the commission.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until July 9 for furnishing pig-iron, track spikes, electric motors, etc. Blanks and general information relating to this circular (No. 941) may be obtained at the above office or the offices of the assisting purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

CEBU, P. I.—Within the next six months the Visayan El. Co., of Cebu, expects to erect a reinforced-concrete power house; also to purchase two 60-kw, 60-cycle, 2200-volt generators directly connected to either turbines or simple condensing engines. The company is in the market at all times for prices, etc., for material for distribution and lighting system. Albert Bryan is president and general manager.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JUNE 15, 1915.

[Prepared by Mitchell & Allyn, 41 Park Row, New York.]

1,142,791. ELECTRICAL EQUIPMENT FOR INTERNAL-COMBUSTION ENGINES; V. G. Apple, Dayton, Ohio. App. filed Sept. 9, 1912. Combined lighting, charging and starting system.

1,142,804. TELEPHONE-RECEIVER SUPPORT; A. H. Drake, Waterloo, Ia. App. filed Jan. 28, 1914. Hinged arm supports receiver adjacent to the ear.

1,142,812. ELECTRICAL SIGNAL; C. M. Saeger, Allentown, Pa. App. filed Feb. 15, 1915. Detects and reports trains violating block signals.

1,142,818. CAP FOR LAMP SHELLS, SWITCH RECEPTACLES AND ANALOGOUS DEVICES; C. J. Klein, Milwaukee, Wis. App. filed April 8, 1912. Special means for holding insulating lining.

1,142,819. CAP FOR LAMP SOCKETS AND THE LIKE; C. J. Klein, Milwaukee, Wis. App. filed April 8, 1912. Has a metallic lining with an enamel insulating surface.

1,142,833. ELECTRIC WELDING; J. A. Muir, Cincinnati, Ohio. App. filed April 6, 1914. Same machine may be used under different work conditions.

1,142,835. OUTLET BOX FOR PROTECTIVE CASINGS FOR LINE CONDUCTORS; T. E. Murray, New York, N. Y. App. filed March 10, 1913. Special sheet-metal construction.

1,142,847. CIRCUIT-CONTROLLING MECHANISM; E. Schildhauer, Culebra, Canal Zone. App. filed June 8, 1912. High-potential device.

1,142,852. ELECTROMAGNET AND SOLENOID; A. Simon, Milwaukee, Wis. App. filed June 6, 1910; renewed Oct. 10, 1913. Automatically reduces flow of current after winding has responded.

1,142,857. AUTOMATIC TELEPHONE SIGNALING SYSTEM; M. Suwa, Tokyo, Japan. App. filed Oct. 7, 1913. While telephone is in use the local batteries are cut off from the signaling circuits.

1,142,858. ELECTRO-RESPONSIVE REGULATOR; L. L. Tatum, Milwaukee, Wis. App. filed Nov. 6, 1911. Effects very fine degree of regulation.

1,142,859. ELECTRIC SWITCH; A. A. Tirrill, Schenectady, N. Y. App. filed Oct. 28, 1909. Snap switch operated by suspension cord.

1,142,861. ELECTRICAL HEATING UNIT; E. G. Van Wie and R. W. Davenport, Detroit, Mich. App. filed Nov. 25, 1912. For cooking ranges.

1,142,862. ELECTRICAL HEATING UNIT; E. G. Van Wie and R. W. Davenport, Detroit, Mich. App. filed Nov. 25, 1912. Resistor is wound around a ribbed supporting member.

1,142,875. ELECTRO-MEGAPHONE RECEIVER, ETC.; C. K. Cregier, Chicago, Ill. App. filed Nov. 13, 1911. A loud-speaking telephone with mechanical amplifying means.

1,142,866. ELECTRIC-CURRENT GENERATOR; J. M. Wilson, Newark, N. J. App. filed Dec. 4, 1912. For automobiles; iron-clad type.

1,142,881. PANTOGRAPH GROUNDING CIRCUITS FOR ELECTRIC-RAILWAY VEHICLES; E. R. Hill, East Orange, N. J. App. filed April 3, 1915. By which "supposedly" dead parts of the locomotive can be connected to ground.

1,142,898. THERMO-ELECTRIC AMMETER; P. M. Lincoln, Pittsburgh, Pa. App. filed Feb. 12, 1913. The resistance element heats a thermo-battery.

1,142,920. IGNITION SYSTEM FOR INTERNAL-COMBUSTION ENGINES; H. R. Van Deventer, Sumter, S. C. App. filed Dec. 24, 1914. Current at the sparking points is periodically reversed.

1,142,935. SUPPORT FOR ELECTRIC TROLLEY MECHANISM; F. C. Coseo, Columbus, Ohio. App. filed May 28, 1909. For mine locomotives.

1,142,939. ELECTRICALLY HEATED OVEN; R. W. Davenport, Detroit, Mich. App. filed Oct. 10, 1914. Heats partly by radiation and partly by convection.

1,142,973. ELECTRICAL APPARATUS; J. H. Lehman, New York, N. Y. App. filed Dec. 6, 1912. Ignition for internal-combustion engines.

1,143,002. TROLLEY RETRIEVER; F. A. Wasson, Milwaukee, Wis. App. filed Nov. 21, 1912. Utilizes compressed air from the brake system.

1,143,008. AUTOMOBILE OR TRAIN-LIGHTING SYSTEM; C. E. Willey, Louisville, Ky. App. filed March 28, 1913. Electromagnet means for checking speed of the generator.

1,143,024. ELECTRICAL SIGNALING APPARATUS; D. E. Beatley and P. M. Feltwell, Sewickley, Pa. App. filed Nov. 13, 1914. For automobile use to signal pedestrians.

1,143,041. CURRENT CORRECTOR; N. C. Darby, East Orange, N. J. App. filed July 31, 1913. For converting alternating current to direct current.

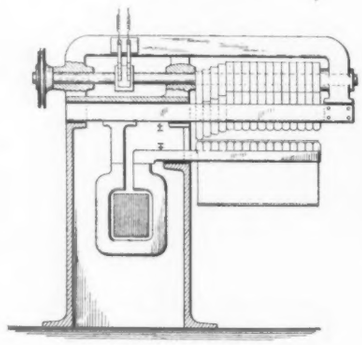
1,143,050. FLATIRON; S. Kako, San Francisco, Cal. App. filed April 26, 1915. Electrically heated; generates steam which is applied to the goods being pressed.

1,143,097. MEDICATED MOUTHPIECE CONNECTOR; C. M. Andres, Albany, N. Y. App. filed Nov. 8, 1913. Supports a strip of paper across mouthpiece which can be unwound from rod.

1,143,108. ARC LAMP; J. L. Dinsmoor, New York, N. Y. App. filed Oct. 6, 1911. Inclined carbons, with single coil operating a double clutch.

1,143,119. MAGNETO; D. B. Hughes, New York, N. Y. App. filed May 10, 1912. Transformer is supported in the horseshoe magnet adjacent to the armature.

1,143,140. TELEPHONE-CALL REGISTER; J. A. Robinson, Denver, Col. App. filed May 26, 1913. Impossible to register call unless double operation is performed.



1,143,220—Electric Welding

1,143,149. INSULATOR; L. Steinberger, Brooklyn, N. Y. App. filed Feb. 10, 1912. Rigid type for high potentials.

1,143,175. SYNCHRONOUS ELECTRICAL-CONTACT MAKER; F. G. Cottrell, Berkeley, and H. A. Burns, Oakland, Cal. App. filed Sept. 9, 1909. Intermittently makes contact to maintain constant polarity.

1,143,176. ELECTRIC SYSTEM; J. L. Creveling, New York, N. Y. App. filed Sept. 30, 1909. Storage-battery charging.

1,143,181. DRY CELL; M. A. Foos, Fremont, Ohio. App. filed Dec. 2, 1912. A guard prevents the mix from falling between the lining and the container electrode.

1,143,189. ELECTROMAGNETIC SOUND PRODUCER; L. Grubman, New York, N. Y. App. filed May 23, 1914. Single auto-horn construction.

1,143,191. ELECTRICAL SYSTEM; G. W. Hallock, New York, N. Y. App. filed Dec. 7, 1909. Car-lighting.

1,143,194. MOTOR CONTROLLER; C. T. Henderson, Milwaukee, Wis. App. filed July 29, 1913. Automobile starter.

1,143,201. ELECTRIC TALKING SIGN; L. H. Jones, Wichita, Kan. App. filed April 14, 1914. Simplified construction and increased range.

1,143,206. ELECTRIC SWITCH DEVICE AND RECEPTACLE; C. J. Klein, Milwaukee, Wis. App. filed April 28, 1911. Push-button lamp socket.

1,143,213. METHOD AND APPARATUS FOR CONVERTING ALTERNATING OR PULSATING ELECTRIC CURRENTS INTO UNIDIRECTIONAL CURRENTS; R. W. Lohman, Oakland, Cal. App. filed May 22, 1909. Rotating electrostatic field.

1,143,220. ELECTRIC WELDING; R. Mack, Berlin, Germany. App. filed Feb. 29, 1912. Continuous-point welding operation.

1,143,264. ELECTRICAL PUSH-BUTTON; C. A. Franck, Yonkers, N. Y. App. filed Feb. 3, 1914. Button part can be readily removed to permit wiring.

1,143,270. AUTOMATIC SHIP'S BELL; J. E. Hudson, Batavia, N. Y. App. filed Feb. 16, 1912. Solenoid operates clapper.

1,143,305. TRANSFORMER; L. C. Nichols, Milwaukee, Wis. App. filed April 8, 1911. Spacing strips are made zigzag shape to brace all the wires of the different sections.

1,143,306. COMBINED ATTACHMENT PLUG AND BASE; M. Norden, New York, N. Y. App. filed April 24, 1914. Simplified plug construction.

1,143,312. SIGNALING CIRCUITS; W. M. Perry and A. E. Boozer, Columbia, S. C. App. filed March 25, 1912. For calling nurses in a hospital, etc.

1,143,313. SIGNALING SYSTEM; W. M. Perry, Columbia, S. C. App. filed March 29, 1912. Hospital calling system, free of "drops," etc.

1,143,322. OUTLET BOX; M. Robinson, Newton, Mass. App. filed April 8, 1908. For use with any number of flexible-wire receiving conduits.

1,143,327. VACUUM REGULATION; H. C. Snook, Cynwyd, and E. W. Kelly, Philadelphia, Pa. App. filed July 3, 1914. For X-ray tubes. (Eighty-two claims.)

1,143,368. SWITCH SELECTOR; A. F. Dixon, Newark, N. J. App. filed Dec. 12, 1914. For printing telegraphs.

1,143,404. TYPEWRITER; E. E. Kennedy, Neepawa, Manitoba, Canada. App. filed Aug. 30, 1913. Electric motor automatically returns and spaces the platen.

1,143,412. UNDERGROUND CONDUIT CONSTRUCTION; M. H. Loughridge, New York, N. Y. App. filed June 5, 1912. Made of blocks of molded stone.

1,143,425. APPLICATION OF POWER TO RECIPROCATING-BED PRINTING PRESSES; R. Miehle, Chicago, Ill. App. filed Sept. 5, 1911. Driving motor accelerated and then decreased in speed near ends of stroke of press bed.

1,143,485. BATTERY CONNECTION; C. H. Beck, Altoona, Pa. App. filed Aug. 31, 1914. Clip construction, dispensing with usual nut and screw terminals.

1,143,487. MICROPHONE AND LIKE INSTRUMENT; E. Belin, Paris, France. App. filed July 31, 1913. Microphonic contacts with the properties of a rheostat.

1,143,491. WIND SHIELD; E. P. Bidwell, Monrovia, Cal. App. filed June 17, 1914. Heating element between two panes to dry moisture thereon.

1,143,493. APPARATUS FOR MOUNTING FILAMENTS; L. Borzychowski, Berlin, Germany. App. filed June 3, 1912. For winding the filaments over the supporting arms.

1,143,529. MAGNETOMETER; E. Garretson, Buffalo, N. Y. App. filed Feb. 11, 1914. For determining strength, etc., of electromagnet.

1,143,539. HEADLIGHT; C. A. B. Halvorson, Jr., Saugus, and L. O. Ingalls, Lynn, Mass. App. filed Nov. 25, 1911. For luminous or flaming electrodes.

1,143,568. ELECTRIC WATER HEATER; R. P. Barnstead, Boston, Mass. App. filed Jan. 27, 1913. For producing distilled water.

1,143,572. ELECTRIC HEATER; H. W. Denhard, Milwaukee, Wis. App. filed Aug. 31, 1910. Flatiron with cut-out operative when heat becomes excessive.

1,143,573. AUTOMATIC CUT-OFF FOR ELECTRICALLY HEATED DEVICES; H. W. Denhard, Milwaukee, Wis. App. filed Jan. 30, 1911; renewed Dec. 4, 1912. Thermostat renders switch-throwing spring operative.

1,143,574. ELECTRIC RESISTANCE ELEMENT; H. W. Denhard, San Francisco, Cal. App. filed Oct. 31, 1911. Flat strip conforming to general outline of flatiron.

1,143,575. ELECTRIC RESISTANCE ELEMENT; H. W. Denhard, San Francisco, Cal. App. filed Oct. 31, 1911. Formed of single flat strip bent to shape of flatiron.

1,143,576. ELECTRIC RESISTANCE UNIT; H. W. Denhard, San Francisco, Cal. App. filed Oct. 31, 1911. Slotted resistance ribbon wound in parallel convolutions about a flat base.

1,143,577. ELECTRIC RESISTANCE UNIT; H. W. Denhard, San Francisco, Cal. App. filed Oct. 31, 1911. Resistance wire wound on base between sheets of insulating material.

1,143,578. ELECTRIC HEATER; H. W. Denhard, San Francisco, Cal. App. filed Oct. 31, 1911. Resistance unit for toasters, etc.

1,143,579. ELECTRIC HEATER; H. W. Denhard, San Francisco, Cal. App. filed Oct. 31, 1911. Automatically controlled curling iron and grease-paint heater.

1,143,586. PROCESS OF PRODUCING CHLORATES OF ALKALIS AND ALKALINE EARTHS; W. Laib, Rittman, Ohio. App. filed Sept. 12, 1914. Electrolysis for producing potassium chlorate.

Monthly Commercial Section in this Issue

Electrical World

Volume 65, Number 26 McGraw Publishing Co., Inc. New York, June 26, 1915

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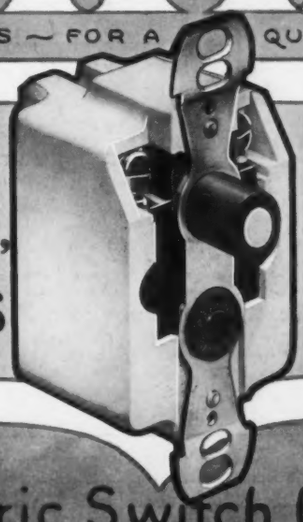

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Electrical World

New York, June 26, 1915

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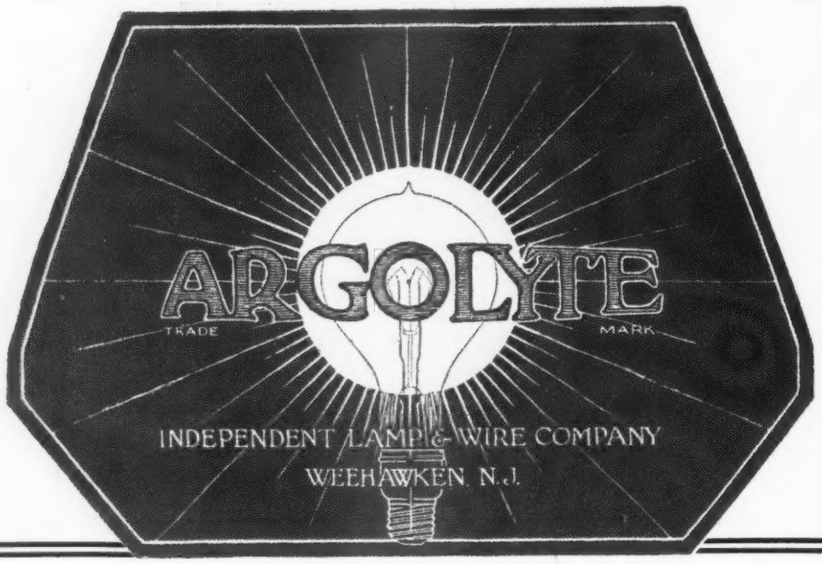

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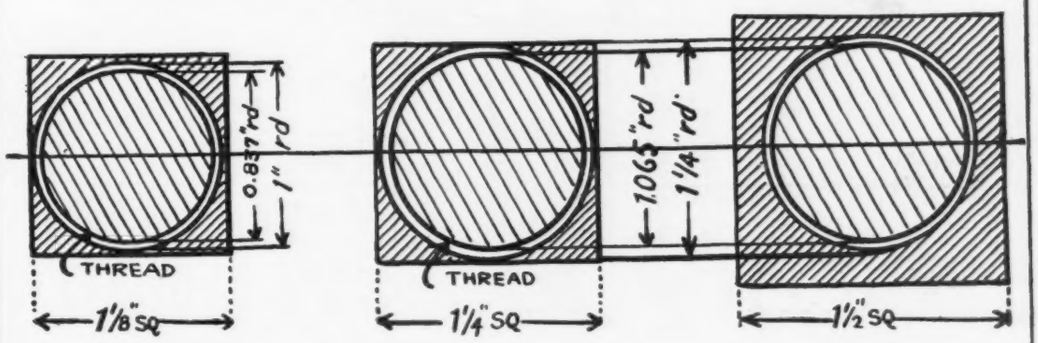

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1-inch, 1⅛-inch and 1¼-inch round rods were decided upon. Tests were made to make sure that we were right. In soft loam they were O. K. but in stiff clay they twisted off where the thread entered the casting. It was then necessary to either get away from the threaded rods on account of the twisting strain or to greatly increase the diameter of the rod to compensate for the reduction in diameter due to the threading and to give sufficient strength to stand the twist.

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They did not have to be torsionally weakened by threading and the resistance to twisting was considered greater. A glance at the cross-sections above will quickly show you why this is so. You can easily see that there is less metal in the round rods than in the square. Further experiments showed that the rods that were right were 1⅛, 1¼ and 1½ inches square.

A reference to Kent's Mechanical Engineers' Pocket Book, Sixth Edition, Pages 281 and 282, will show you the formulae by means of which we learned how much stronger, torsionally, are square rods whose sides equal the diameter of round rods made of the same material. It figures out this way:

One inch square = 1.8 times as strong as one inch round with standard thread.

One and one-eighth inch square = 2.7 times as strong as one inch round with standard thread and 1.8 times as strong as one and one-eighth round rod threaded.

One and one-quarter square = 1.8 times as strong as one and one-quarter round threaded.

One and one-half square = 3.1 times as strong as one and one-quarter inch threaded and 2.0 times as strong as one and one-half inch round rod threaded.

These figures are somewhat astonishing when one first views them. Of course it is not necessary to have rods of 1⅛, 1¼ and 1½ inches square for holding power (tensile strength) but it is necessary to have them of these great cross sections for two reasons: First, to stand the torsional (twisting) strain without twisting off or weakening the rod and Second, it being necessary to make the rods out of steel to get greater torsional strength it is desirable to have at least twice the cross section necessary for tensile strains because of the fact that steel corrodes much more rapidly than does an iron product that is more nearly pure iron.

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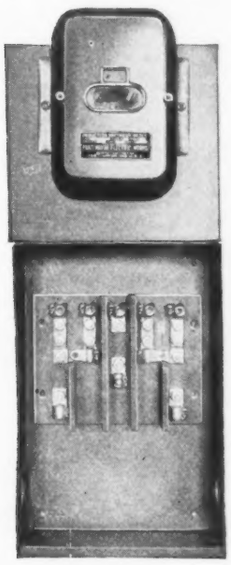

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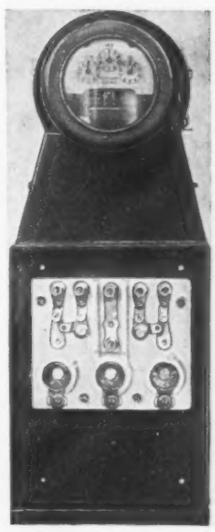
The J-M line of Meter Protective Devices offers absolute revenue protection by making it impossible for unauthorized persons tampering with the meter.

It does more than that. It provides for adequate fusing, safe testing, protection of customers' and testers' lines during test and also the cutting in of the meter when tester is through.



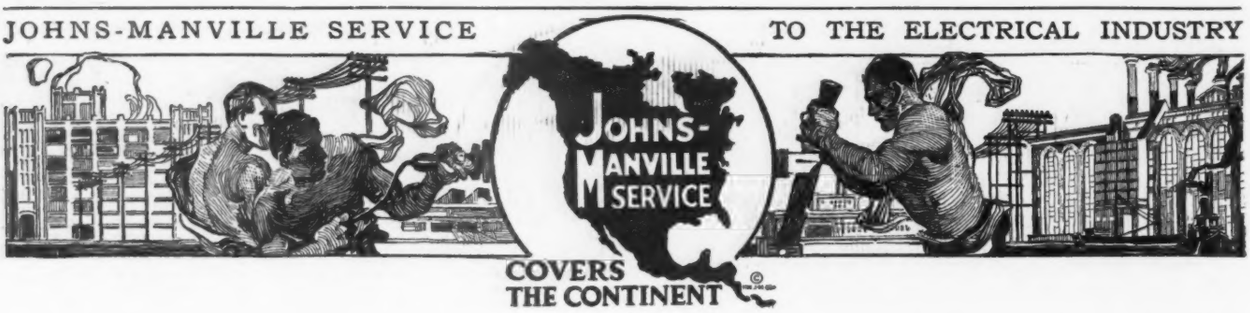
This line is made to accommodate all standard commercial meters D.C. or A.C., single or polyphase with fused or solid potential tape and in capacities from 5 to 1000 amperes. Get all the facts from **your** J-M branch.

H. W. JOHNS-MANVILLE CO.

Akron	Boston	Columbus	Duluth	Kansas City	Minneapolis	Philadelphia	St. Paul	Toledo
Albany	Buffalo	Dallas	Galveston	Los Angeles	Newark	Pittsburgh	Salt Lake City	Washington
Atlanta	Chicago	Dayton	Houghton	Louisville	New Orleans	Portland	San Francisco	Wilkes-Barre
Baltimore	Cincinnati	Denver	Houston	Memphis	New York	Rochester	Seattle	Youngstown
Birmingham	Cleveland	Detroit	Indianapolis	Milwaukee	Omaha	St. Louis	Syracuse	

THE CANADIAN H. W. JOHNS-MANVILLE CO., LTD., Toronto, Winnipeg, Montreal, Vancouver 3225

JOHNS-MANVILLE SERVICE TO THE ELECTRICAL INDUSTRY



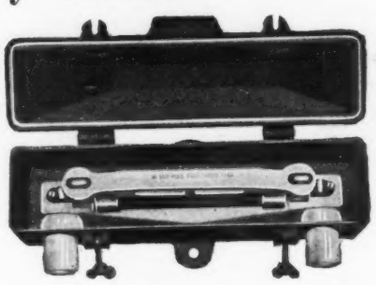
Transformer protection with a factor of safety of 400%—"Noark" Primary Boxes

A rugged pole line and feeder fuse box that will stand all kinds of weather without impairment of insulation strength. Permits of easy and safe re-fusing, by reason of the porcelain carrier with which the fuse is handled.

Its construction admits of ready installation either on poles, building walls or manholes.

These Primary Boxes can be furnished to meet every possible requirement, and are made to take from ½ to 100 amp. "Noark" 2500-v. fuses.

We offer these boxes with "Noark" Fuses because their design, particularly in higher voltage, is absolutely superior.



J-M Tapes represent the solution of your own problems in insulating wrappings

It takes more than technical knowledge, good materials or equipment to become a factor in Electrical Tape manufacture. True, that all these are necessary, but the most valuable factor is experience. For it is this that gives the tape manufacturer his knowledge on what the field needs.

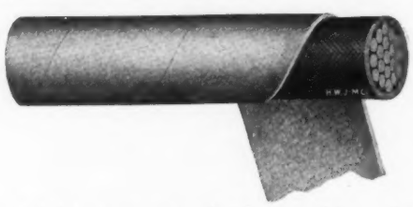
In catering to the tape requirements of many large users, a complete line has been developed that will cover practically all requirements of manufacture or utility.

Your assurance as to uniform quality and delivery is made positive by our large facilities in manufacture and our buying power in raw materials.

Let us quote you on your needs in friction rubber, asbestos and paper tapes.

The Electrical Department in any branch is at your service.

Whether cables are under water or overheated —J-M Niagrite will protect them



Here is a cable wrapping that is both non-hygroscopic and fire resistant. It will localize any abnormal heating effect in the cables and will prevent arcing over between adjacent cables. It is also impervious to water and is extremely hard and strong.

J-M Niagrite when applied is a flexible felt of an asbestos base which after wrapping is saturated with J-M fire and waterproof compound. On drying, Niagrite becomes extremely hard and stone-like.

J-M Niagrite is specified by many Central Stations, Railway and Industrials as a standard sheathing for manhole, subway and switchboard locations.

JOHNS-MANVILLE PRODUCTS

"Noark" Protective Devices.
J-M Ebony Asbestos Wood.
Overhead Line Material.
Friction Tapes and Splicing Compounds.
Moulded Insulations.
J-M Lighting Service.
Frink & J-M Linolite Systems of Lighting.
Mitchell Vance Lighting Fixtures and Bronzes.
Linolite Lamps.
J-M Dry Batteries.

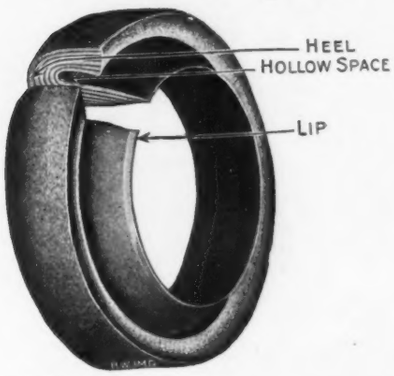
Boiler Room Specialties

J-M Asbestos and Magnesia Pipe and Boiler Coverings.
J-M Fire Extinguishers.
J-M Flexible Metallic Armoured Hose.
J-M Kearsarge Gaskets.
J-M Permanite Sheet Packing.
J-M Sectional Underground Conduit.
J-M Vitribestos Smoke Stack Lining.

3225

JOHNS-MANVILLE SERVICE TO THE ELECTRICAL INDUSTRY

Packing is usually held against the rod by constant gland pressure but J-M Sea Rings by a varying fluid pressure

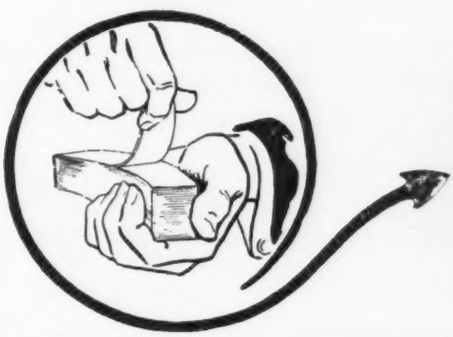


It is true that all rod packings must withhold the greatest tendency of leakage past them—the maximum.
To accomplish this, the gland must be adjusted accordingly.
But here is the important point.
The maximum fluid pressure against rod packing is exerted only part of the time, nevertheless the gland is constantly squeezing the packing hard to meet that maximum demand. The gland is not automatic.
J-M Sea Rings do not pack by gland pressure—they pack by fluid pressure—automatically. Their pressure on the rod is measured by the pressure or tendency of leakage past them.
This is why they save power and wear.

1/16" Seigelite equals 1/8" rubber sheet in packing service—and costs less

What is the use in buying ⅛" sheet rubber and squeezing it down to a 1-16 in the joint, when you can buy 1-16" Seigelite 711 sheet to pack the same joint.
Seigelite 711 is extremely dense, practically incompressible—but resilient.
Oil, grease, gasoline or water only toughen it. Seigelite 711 costs less than rubber or cloth insertion packings.

You can't do this to Universal Packing because it's all in one piece folded together



This is J-M Universal

The frictional rubbing of hydraulic packing against the cylinder tends to separate the laminations, constant wear frays the packing on the working edge and soon renders it useless.
J-M Universal Packing presents rounded shoulders of continuous fabric against the wearing surfaces. This is why J-M Universal does not splay out like a worn broom. The ideal packing for inside packed pumps.

H. W. JOHNS-MANVILLE CO.

Other J-M Engine Room Products; Asbestos Packings; Pipe Coverings; High Temperature Cements; Conduit; Metallic Hose; Fuses; Boiler Plugs; Stack Lining; Tube Cleaners; etc.

Akron	Boston	Columbus	Duluth	Kansas City	Minneapolis	Philadelphia	St. Paul	Toledo
Albany	Buffalo	Dallas	Galveston	Los Angeles	Newark	Pittsburgh	Salt Lake City	Washington
Atlanta	Chicago	Dayton	Houghton	Louisville	New Orleans	Portland	San Francisco	Wilkes-Barre
Baltimore	Cincinnati	Denver	Houston	Memphis	New York	Rochester	Seattle	Youngstown
Birmingham	Cleveland	Detroit	Indianapolis	Milwaukee	Omaha	St. Louis	Syracuse	

THE CANADIAN H. W. JOHNS-MANVILLE CO., LTD., Toronto, Winnipeg, Montreal, Vancouver 3153

Simplicity of Control

is important when motors are to be operated by unskilled workmen. The simpler the control, the less danger there is for damage to the motor, or injury to the workman. But simplicity in control must not be obtained by complicating the control system.

Wagner Single-Phase Motors

—built on the principle of repulsion-starting, and induction-running, merely require a switch for control;—

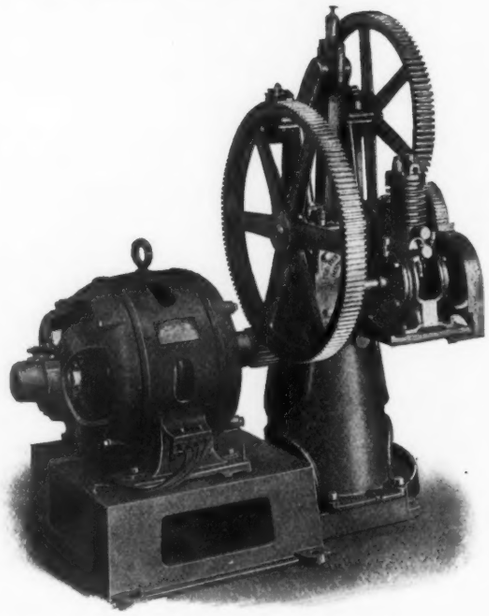
To start the motor:—Close the switch.

To stop the motor:—Open the switch.

It couldn't be any simpler. It simplifies automatic control by float or pressure switch.

Reliability, however, has not been sacrificed for simplicity. We can show records of fifteen and sixteen years of service for these motors, without repairs of any kind, and the motors are still running.

Furthermore, these motors have the great advantage of easily starting loads that require exceptionally heavy pull at starting, but require only normal pull when up to speed. This is accomplished without drawing excessive current, an important consideration, especially for the small industrial power plant.



Wagner Single-Phase Motor driving a long stroke pneumatic pump.

Operating at constant speed, these motors are adapted to a wide variety of purposes.

Bulletin No. 1014 describes the motor more in detail, and illustrates some of its applications.

Wagner Quality

Wagner Electric

Manufacturing Company, St. Louis, Mo.

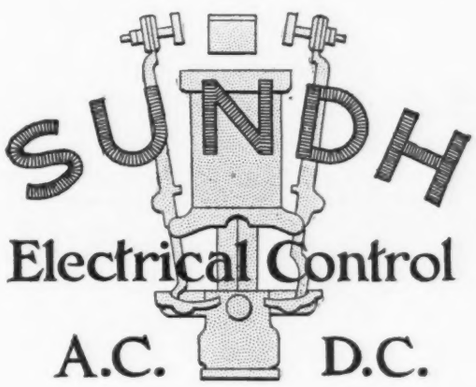
Member Society for Electrical Development. Do it Electrically.

96

RIGHT NOW

If you have an electrical control problem in D.C. or A.C.

—put it up to



The Sundh perpetual catalog is a record of the pioneer work—the pace-making in nearly every branch of remote control work.

No doubt, right now you are figuring on a matter of control and the data we have on that particular subject will save your time and perhaps money.

Put it up to us.

Our experience will prove of valuable assistance.

Tear off the coupon—NOW—Sign—and Send.

Sundh Electric Co.
555 W. 23rd Street
New York

3174 1

FOR INFORMATION

Sundh Elec. Co. 555 W. 23rd St. New York

Please send leaflets on Sundh control for service on

.....

.....

Name .....

Address .....

Can't we get a good motor built especially for us?

"A poor motor is ruining our product", said the Sales Manager. "We've never seemed able to get a motor that is exactly suited to our machine. What we want, what we must have, is a motor that is "fool proof", always reliable, sturdy, compact, light weight,---in short, a motor as good as our product and in every way fitted to it."

That Sales Manager grasped the weakness of many of the present motor driven devices. Of what use are the many attachments and exclusive features you've worked so hard to incorporate into your machine if the motor goes wrong? Remember, people don't blame the motor when it balks---they condemn the whole machine.

We are small motor specialists and our engineers challenge you to put an application up to them that they can't solve. Not only that, but we have the best equipment and organization in the country with which to build both standard and special motors in any quantities.

If you have a machine or especially if you market a product and wish to equip it with the best fractional horse power motor, it will pay you to send for our Bulletin 1146 and learn what we are doing for the majority of the leading manufacturers of industrial and domestic power driven devices.

FORT WAYNE ELECTRIC WORKS

OF GENERAL ELECTRIC COMPANY

"WOOD" SYSTEMS

Main Office
FORT WAYNE, INDIANA

Branch Offices
ALL LARGE CITIES

M-46

Central Station Revenue

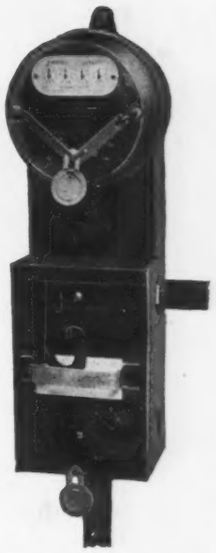
depends very largely upon the watthour meter and the service equipment.
How much unmetered energy are you losing due to unprotected service and meter wiring?

PROTECTION FIRST

METROPOLITAN PROTECTIVE DEVICES

where installed have increased the revenue and efficiency of many Central Stations. Why not let them do the same for you?

Let us send you full particulars

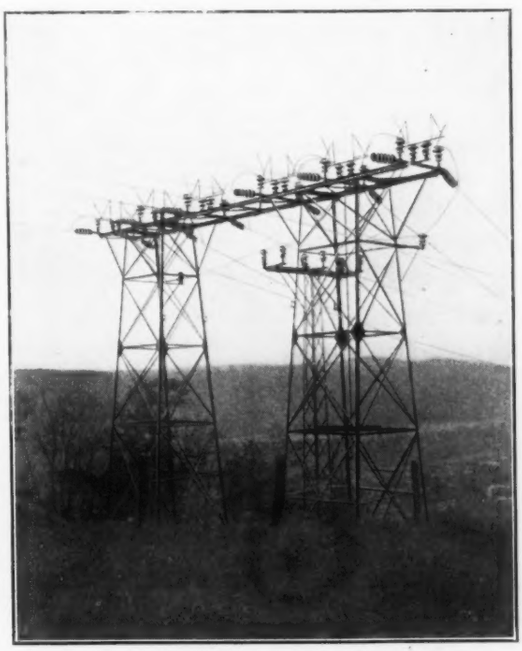


List No. 118—Combination enclosed service switch and meter protective device—switch mechanism in closed position. This is a complete tamper-proof service and meter equipment.

Metropolitan Engineering Co.
42nd Street Building **New York**

Canadian Representative—
Metropolitan Engineering Co., Ltd.
90 Sherbourne St., Toronto, Canada

LIMIT THE TROUBLE AREA



Sectionalizing Station, Wheeling Electric Co., Rayland, O.

Don't let a breakdown cripple your entire line.

Sectionalize Power Distribution *with* Burke Horn Gap Switches

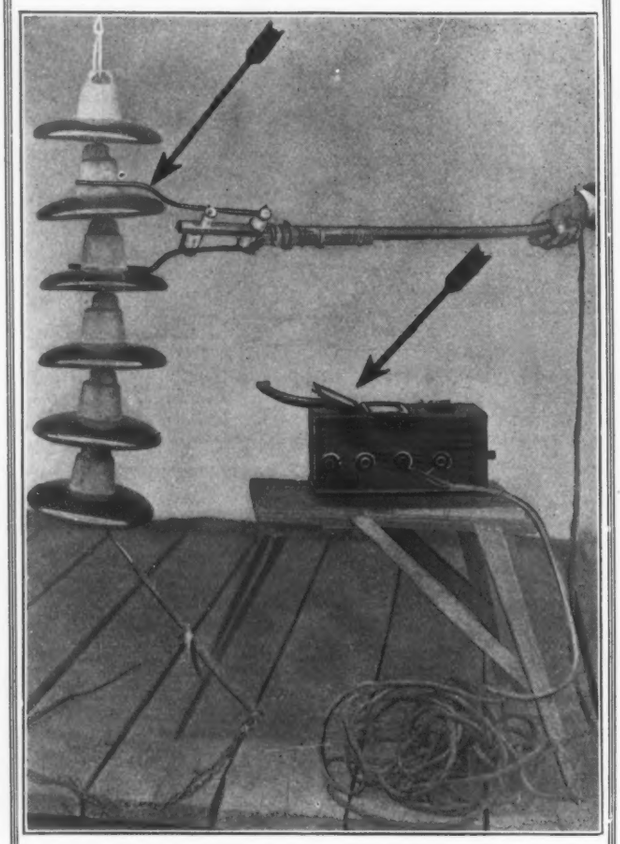
You can rapidly locate and localize the trouble without interrupting service on the whole line.

The Burke Horn Gap Switch will open under heavy load. Two insulators on the rotor take the torsional strains off the main insulator. Operation is certain under all weather conditions because of the copper-leaf brush contact protected by a sleet hood—no more blade and jaw trouble.

Investigate Burke Equipment for line protection.

Railway & Industrial Engineering Co., Pittsburgh, Pa.
Works and Main Office: GREENSBURG, PA. **New York Agency: 50 Church Street**

Test Insulators
by the Megger-Method!



Most of the great Power Companies in America that operate high-tension transmission lines, make use of one or more MEGGER TESTING SETS for detecting *faulty insulators* (especially of the suspension type).

The picture above shows a special "fork" devised by the engineers of a company in the far west; and also the megger to which it is attached.

With an outfit of this character, three men (a lineman, a groundman and a megger-man) can make tests rapidly—as compared with any other scheme—and soon become so expert that the *results* are *"very satisfactory indeed,"* as reported by a prominent and enthusiastic user.

The same megger which is suitable for testing insulators is equally adapted for indicating the insulation characteristics of cables, generators, motors, transformers and other station equipment; and therefore has a wide field of usefulness.

If the subject of insulation testing interests you, write today for our New Pamphlet—"An Ounce of Prevention."

James G. Biddle
1211-13 Arch St., Philadelphia

When in Philadelphia, be sure to visit our Permanent Exhibit of Electrical Instruments

The *On-Time* Advertiser

who gets his copy and cuts to us well before the day his advertisement should go to press, gets better type composition, better location and a better opportunity to make necessary corrections on the proofs which can then be submitted before publication.

The *Last-Hour* Advertiser

whose copy and cuts come in at the last minute or even later, gets the best attention we can possibly give. We work overtime to do what we can for him. But the lack of sufficient time makes it physically impossible to do as well for him as for the advertiser whose instructions come in well before the last hour.

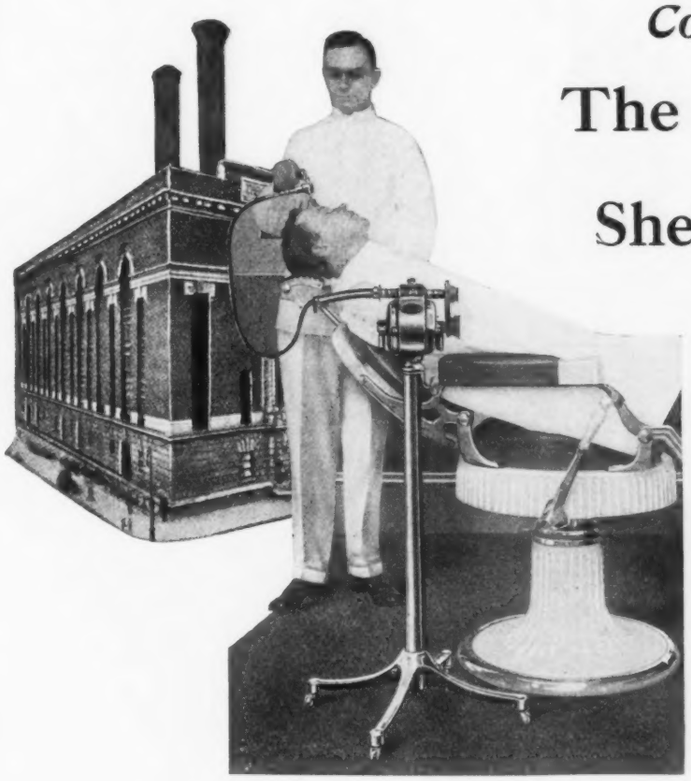
Get Your Copy and Cuts in *Early*

Do this, not on our account, but for the sake of your own advertising. We want to serve all advertisers equally well — but we can't put more hours into a day, and the advertiser who gives us the most time gets the best results.

Copy and cuts should be in our hands by Friday of the week preceding the date of issue. This means that Friday is the **last** day on which changes of copy can be handled normally.

For good advertising, get your cuts and copy in every week **before** Friday.

Electrical World
239 West 39th Street, New York



Common Interests

The Central Station
and
Shelton Vibrators

The Vibrators have passed out of the luxury stage into the necessity stage. Their use is now common in hospitals, physicians' offices, massage and barber establishments, hair-dressing establishments, hotels, baths, home, etc.

Wherever their usefulness has been demonstrated, they have encouraged wiring, with important results to central station current sale.

To build up the demand for the Shelton Line we have a carefully planned sales campaign that will arouse interest throughout your territory.

We would advise you to study this important method of boosting central station work.

Write today.

Shelton Electric Company

NewYork Chicago Boston San Francisco

"Look for the Gray Shell"

Mail the coupon today
and receive the following:

1. Proof that **Economy renewable cartridge Fuses** save 80% over the annual fuse maintenance expense of old style non-refillable fuses.
2. A list of prominent users, including the U. S. Government industrial plants, steam and electric railroads, hotels, mines, department stores, central stations, etc.
3. The Economy Catalog No. 27A.
4. **Free Samples** to prove every claim we make.

Do It Now

Economy Fuse & Mfg. Co.

Kinzie and Orleans Sts.
CHICAGO

ECONOMY FUSE & MFG. CO.
Kinzie and Orleans Sts., Chicago
Please send Catalog No. 27A, list of users and free samples for ..... amperes ..... volts.
.....
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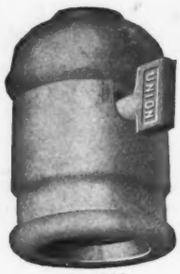
No. 503

No. 516

No. 514



No. 511

MONEY ALL ALONG THE LINE

"UNION" SOCKETS are always a profitable proposition for the dealer and jobber because there is some important idea built into each socket.

No. 503 and 514 for instance, have the "snap lock" device instead of a catch to hold the cap to the shell. Yet they are easily opened by a slight pressure of the fingers. It cuts out accidents, and it helps to make sales.

No. 516 is another "lock-shell" Union Socket, except that here the cap and shell are so connected that only a screw-driver can separate them. It is a valuable socket for heavy reflectors, and can be adjusted to the fractional part of an inch. It is an exceedingly fine weight carrier.

No. 511 is a porcelain key socket built for severe mechanical and electrical requirements. It is an "over-load" carrier in several senses.

"Union-Made" also includes the famous "Union" Flush Receptacles, and other Specialties.

Write for the Catalog today.

"UNION" MOULDING RECEPTACLE No. 760.

"UNION MADE MEANS WELL MADE"

UNION ELECTRIC COMPANY

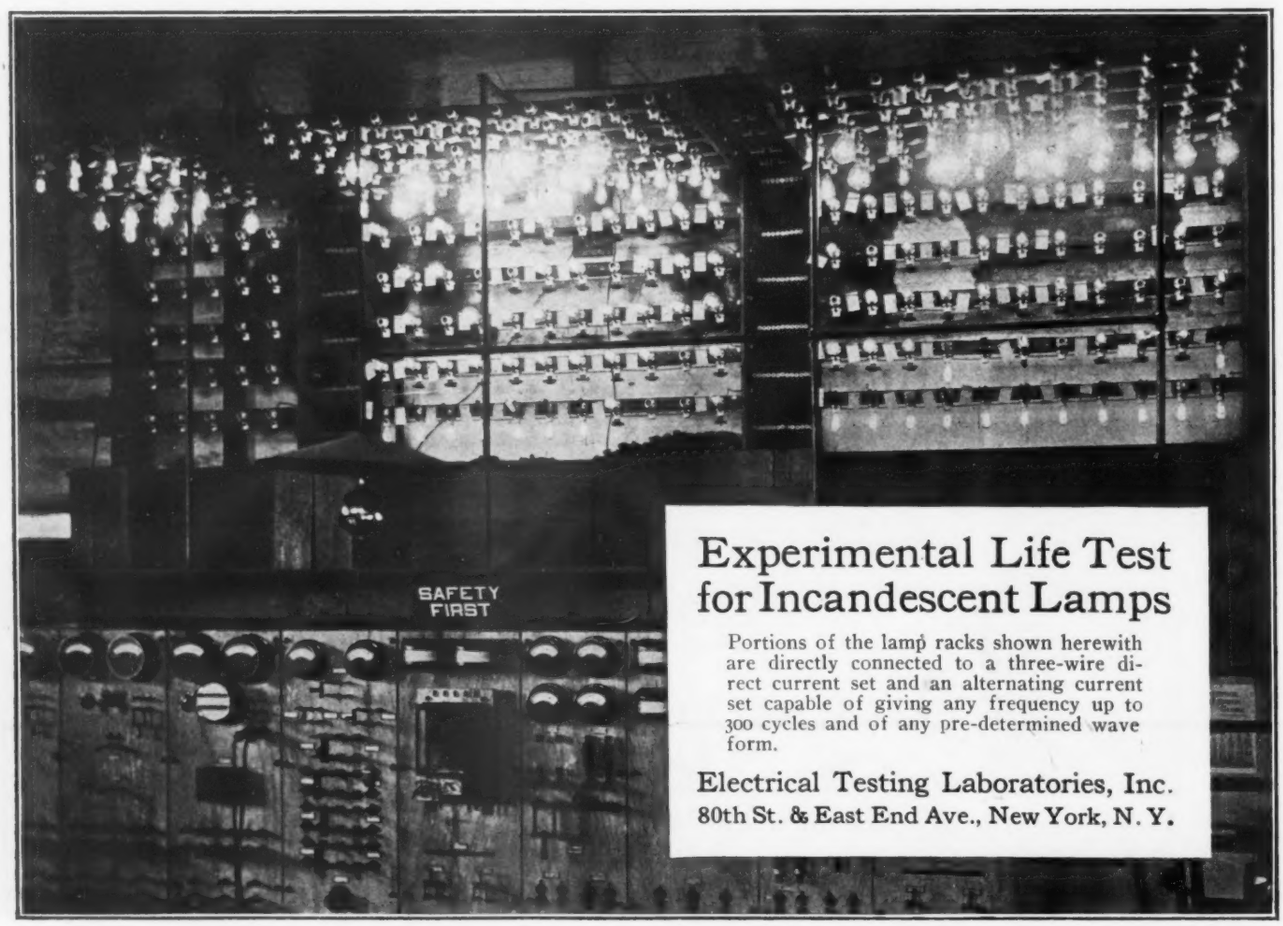
TRENTON, N. J.

DISTRICT SALES AGENTS

SAN FRANCISCO, CAL. 788 Mission St. ST. LOUIS, MO. 1403 Chestnut St. DETROIT, MICH. 213 E. Jefferson Ave. BUFFALO, N. Y. BIRMINGHAM, ALA. Am. Trust Bldg. LA CROSSE. WIS. 1523 Badger St. DENVER, COL. CHICAGO, ILL.

"UNION" MOULDING RECEPTACLE No. 761.

2



Experimental Life Test for Incandescent Lamps

Portions of the lamp racks shown herewith are directly connected to a three-wire direct current set and an alternating current set capable of giving any frequency up to 300 cycles and of any pre-determined wave form.

Electrical Testing Laboratories, Inc.
80th St. & East End Ave., New York, N. Y.

The SOCKET *that* BROKE THROUGH *the* BONDS of TRADITION

Tradition, seemingly fixed, permeates every industry. When new ideas are offered, they are at first scorned, then accepted grudgingly, and finally enthusiastically endorsed as having been favored from the beginning.

Such is the history of the Hubbell Pull Socket. It broke through the bonds of tradition and "arrived."

The Hubbell Pull Socket, the original, has by its unequalled mechanical, electrical and artistic qualities, maintained the lead it won by being first in the field.

Socket shells that never weaken or part under weight or strain, current capacity far in excess of its given rating, double-break mechanism with lightning-quick action that prevents arcing and burning of contacts—are features that enable Hubbell Pull Sockets to make good, and *stay good* through years of service.

All that any Pull Socket has done or can be made to do is done by Hubbell Pull Sockets. Send for price lists, discounts and advertising literature.

HARVEY HUBBELL, INC. - - Bridgeport, Conn.

Send for the New Book
on
Industrial ABolites
for Type "C" Mazdas

It is for the careful purchaser of lighting equipment, for the man who wants long-life service from "C" Mazdas under adverse conditions, for the man who wants to properly capitalize the advantages of the gas-filled lamp.

Perfect Ventilation is a property built into the new ABolite. It is a guarantee of lamp life.

Here is the coupon. Tear it off now, fill in, and send it. You need the book.

The Adams-Bagnall Electric Co.
Cleveland, Ohio

Please send me your book on
"ABolites for Economical Lighting"

Name .....
Address .....
City .....
State .....

The Adams-Bagnall Electric Co.
Cleveland, Ohio

2375 2

The visitor to St. Paul's Cathedral in London looks in vain for a monument of its great architect, Sir Christopher Wren, and finds none, but over his tomb is a Latin inscription which translates "Do you seek his monument? Look about you."

In like manner we say "do you seek an endorsement of the

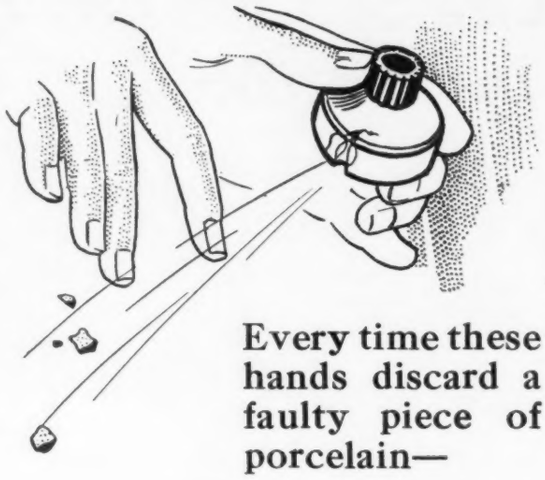
I-T-E CIRCUIT BREAKER?

Look about you." In any modern structure distinguished by reason of its character, magnitude or beauty, I - T - E Circuit Breakers will be found almost without exception. The exception proves the rule.

No other piece of electrical apparatus is held in such universal esteem.

The Cutter Company
Philadelphia

CIRCUIT I-T-E BREAKERS



Every time these hands discard a faulty piece of porcelain—

you lose money

An imperfect fit—a tightly driven screw—and the hands which assemble your electrical specialties reach for a *new* piece of porcelain. How many times a day it occurs in your plant! Yet the expense is not inevitable. It can be greatly reduced by using

STAR

Perfect Porcelain

"Star" Porcelain, among those who use it, stands for Better Porcelain—which means better Workmanship—molding as accurate as your needs demand. In the "Star" plants all work is done by thinking, careful, trained WORKERS. This means QUALITY—and this quality is reflected in reduced porcelain and assembling costs in YOUR plant. Among other things, we are now making special bodies for electrical heating units.

Write for samples

of "Star" porcelain similar to the pieces you are now using. Compare them with yours for quality. Doesn't your good judgment prompt you to make this examination?

The STAR PORCELAIN COMPANY
TRENTON NEW JERSEY
and a new plant at Frenchtown N.J.

41196 1

This Trade Mark The Guarantee of Excellence on Goods Electrical.

Type R2

Type R3

"Commencement Time" for G-E Ranges

Type R domestic electric ranges are now ready for delivery.

These ranges represent supreme quality in design, workmanship and operation. Their convenience, economy of operation and handsome attractive appearance should make ready sales in your locality.

There are many improvements, the most important of which is the sheathed wire heating units—the latest development in the art.

Every G-E range on your line is exceptionally desirable "new business" for you.

Type R1

EQUIPMENT

R—1		
2 Hot Plates	3 Heats	250-500-1000 watts each
1 Oven	2 Heats	500-1000 watts
1 Broiler	1 Heat	1000 watts
3 Vegetable Cookers	1 Heat	200 watts each
Height, 52 in.; length, 33 in.; depth, 26 in.		
R—2		
2 Hot Plates	3 Heats	250-500-1000 watts each
1 Oven	2 Heats	500-1000 watts
1 Broiler	1 Heat	1000 watts
3 Vegetable Cookers	1 Heat	200 watts each
Height, 65⅝ in.; length, 33 in.; depth, 36 in.		
R—3		
2 Hot Plates	3 Heats	250-500-1000 watts each
1 Oven	2 Heats	500-1000 watts
1 Broiler	1 Heat	1000 watts
3 Vegetable Cookers	1 Heat	200 watts each
1 Warming Closet	1 Heat	200 watts
Height, 61½ in.; length, 58 in.; depth, 26 in.		

General Electric Company

General Office: **Schenectady, N. Y.**

Sales Offices in All Large Cities

This Trade Mark The Guarantee of Excellence on Goods Electrical.

This Trade Mark The Guarantee of Excellence on Goods Electrical.

Announcement

A New Drum Type, Quick Break Reversing Switch for Elevator Service

has been added to the well known line of reliable G-E Industrial Control Devices.

These switches are recommended for "high resistance rotor" induction motors and high torque, single-phase motors when the instantaneous starting current does not exceed 150 amperes on standard voltages up to 550. Recommended also for use with slip ring motors which are provided with suitable starters for preventing instantaneous peaks from exceeding 150-amperes.

The mechanical and electrical features of the design have been carefully studied to meet the service which demands safety and reliable operation above all other considerations.

If you are interested in electric elevator operation, ask our nearest office for a description and photograph of the CR-3922 Reversing Switch.

General Electric Company

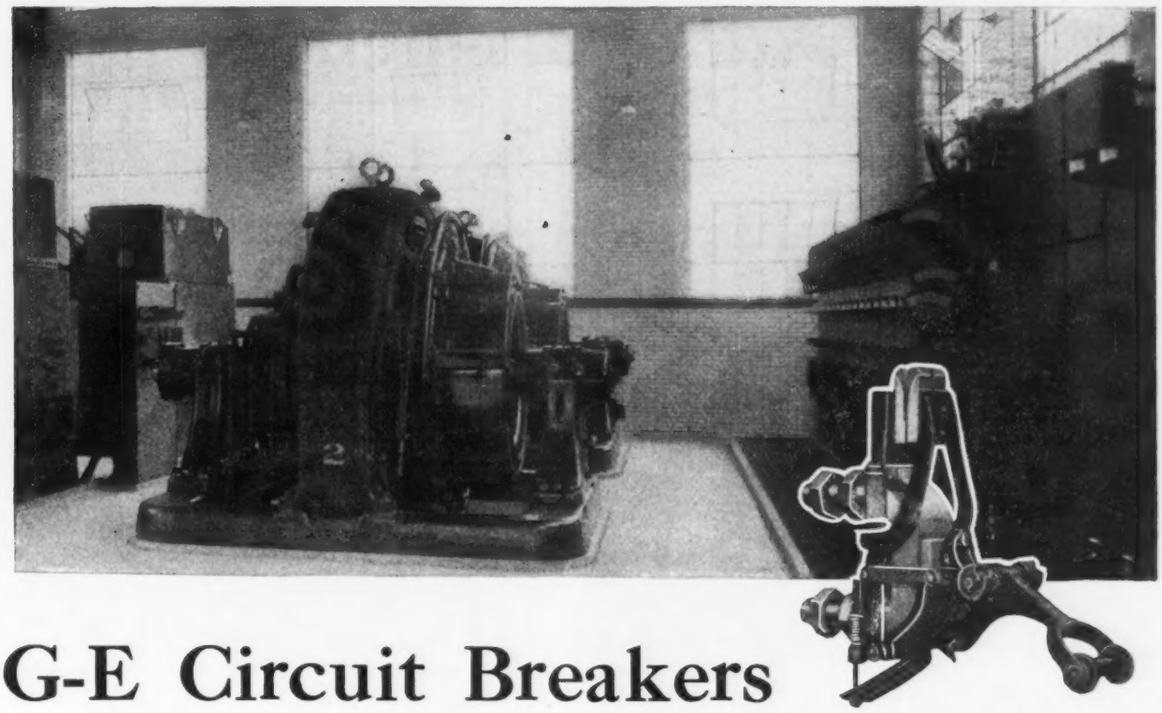
General Office: **Schenectady, N. Y.**

Sales Offices in All Large Cities

5440

This Trade Mark The Guarantee of Excellence on Goods Electrical.

This Trade Mark The Guarantee of Excellence on Goods Electrical.



G-E Circuit Breakers
Protect St. Louis Railway Equipment

The illustration shows a large number of G-E Circuit Breakers controlling and protecting the equipment of the Ann Avenue Substation of the United Railways of St. Louis.

The use of G-E Circuit Breakers in important railway installations in all parts of the country, is an indication of the reputation of these Breakers among the engineers who handle the most important installations.

General Electric Company

General Office: **Schenectady, N. Y.**

Sales Offices in All Large Cities

5413

This Trade Mark The Guarantee of Excellence on Goods Electrical.

A Significant Fact
Of the three Cables in the Trans-Isthmian Duct Line one is a paper-lead telephone cable the other two are
KERITE
(taped and braided) the Panama Railroad's signal cable and the Central and South American Telegraph Company's connection between its Atlantic and Pacific cables.
The severity of the conditions and the importance of the service determined the selection of Kerite for these installations.
KERITE INSULATED WIRE & CABLE COMPANY
NEW YORK CHICAGO

PARANITE
RUBBER COVERED WIRES & CABLES
If its PARANITE its right
More than meets code requirements
Underground, Aerial, Submarine and Inside Use, Telephone, Telegraph, Fire Alarm, Electric Light and Power, Wires and Cables.
THE BEST FOR EVERY PURPOSE
INDIANA RUBBER & INSULATED WIRE CO.
JONESBORO, IND.
CHICAGO BRANCH:
210 S. DESPLAINES ST
EASTERN REPRESENTATIVES:
THOMAS & BETTS Co 105 HUDSON ST., N.Y.

THE STANDARD FOR RUBBER INSULATION
OKONITE
TRADE MARK REG. U.S. PATENT OFFICE
OKONITE Quality
covers completely every argument from durability as proven under actual service conditions to the most exacting test requirements drawn to prove in advance the service to be expected.
THE OKONITE CO.
253 Broadway
New York
15

LEAD COVERED WIRES AND CABLES
With Steel Wire Armor for submarine installation.
With Double Steel Tape Armor for underground installation without conduits.
With Unprotected Lead Sheath for installation in Conduits.
Our equipment enables us to handle the largest sizes in any quantity, but no size or quantity is too small for expert attention.
SIMPLEX WIRE & CABLE Co
MANUFACTURERS
201 DEVONSHIRE ST. BOSTON
CHICAGO SAN FRANCISCO

PUBLISHER'S PAGE

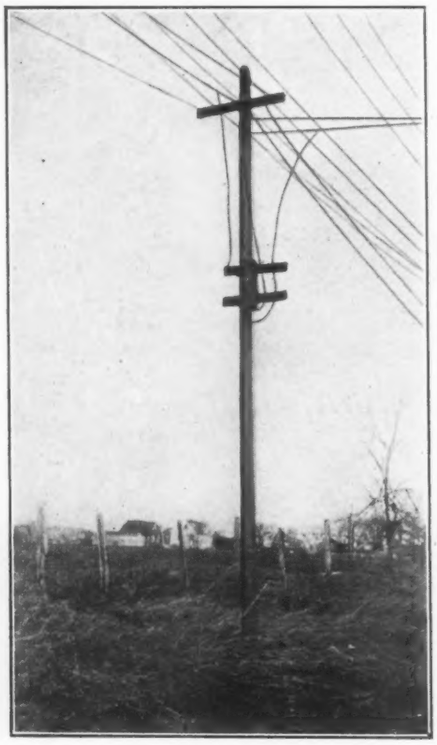
A letter from the Commercial Department of a large lighting Company

recently received by the Electrical World contained this paragraph:

"The instances in which your advertising has helped us in the purchase of devices or material are too numerous to mention completely. We might specify a few as follows:

Conlon Electric Washing Machine
Hold Heat Electric Pads
Electric Steam Radiators."

This is typical of hundreds of letters which come to the Electrical World on this subject. They all show that readers who follow the advertising pages find the time it requires well worth investing. Don't you?



A Light Pole for Heavy Service

Under ordinary conditions you cannot overload a Diamond Tapered Steel Pole. The longitudinal joint conserves all the strength of the metal.

The tapered construction enables you to attach any fixtures with clamps without the possibility of the attachments slipping down the pole.

Makes *sightly* construction—and saves money.

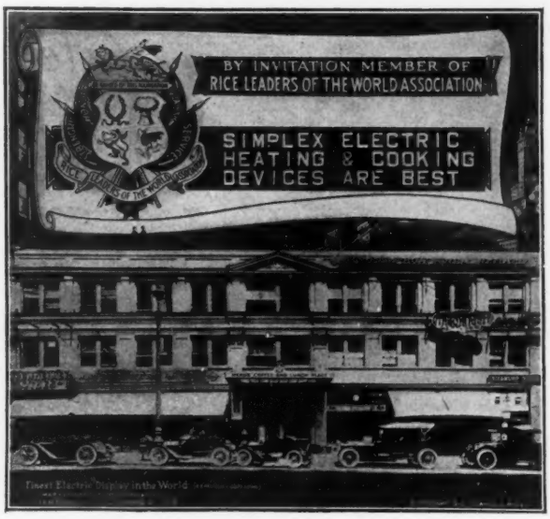
Write us for data and our proposition.

Diamond Steel Pole Co.
Philadelphia, Pa.

3223

Rice Leaders Sign at San Francisco

Greatest Electric Display in the World



100,000

Candle Power of Lights familiarize folks with SIMPLEX ELECTRIC DEVICES

Each week a different message is displayed with eye-compelling, spectacular effect.

Simplex merits are indelibly impressed on the minds of countless thousands of people, when accompanied by the illumination of the Rice Emblem, and the Chariot and Horses which appear to race in fire at breakneck speed.

Visit the Club Rooms of the Rice Leaders Association, Call Bldg., San Francisco, if you go to the Exposition.

Simplex Electric Heating Co.
Member Rice Leaders of the World Association

Cambridge, Mass.
15 So. Desplaines St. Chicago

SIMPLEX ELECTRIC QUALITY
TRADE MARK

Belleville, Ont.
612 Howard St. San Francisco

"Leaders of the World" in all devices for Electric Heating & Cooking

When Testing Your High Tension Feeder Ammeters—

Are your equipment and your men protected against the danger of leaving the current secondary open with the primary alive? You know what it means—an upbuilding voltage that may *burst the transformer like a bomb.*

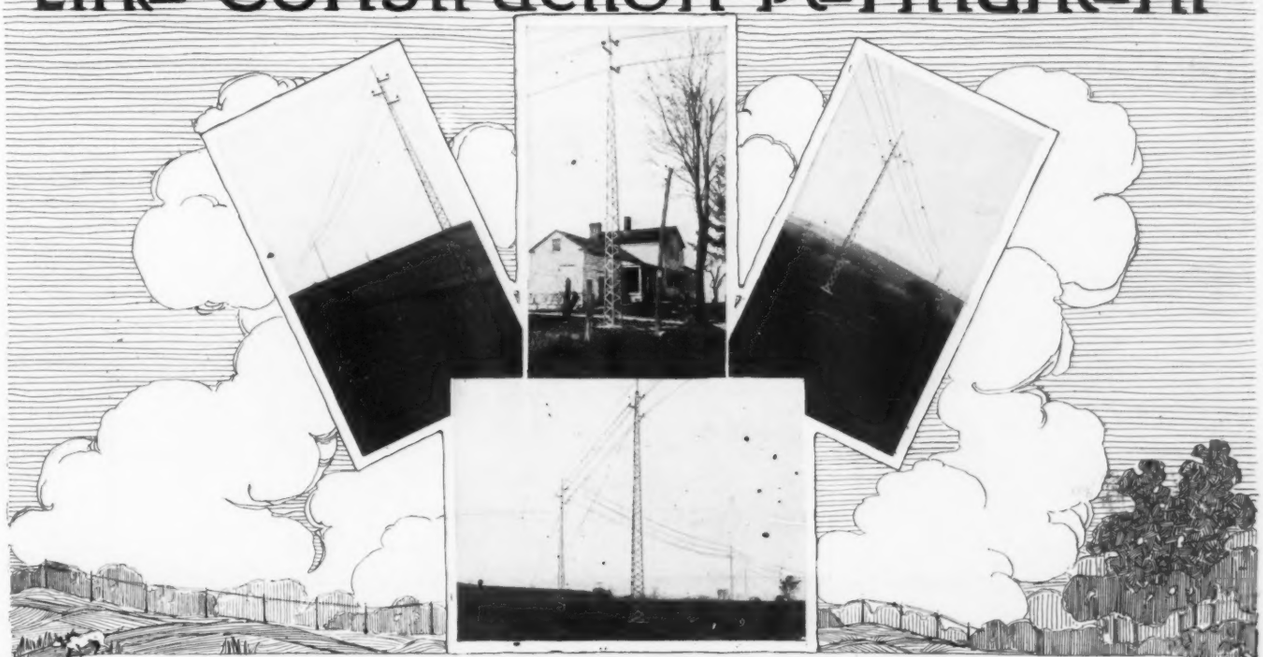
Make Safety Certain by Using

Franklin Instrument Cut Out Switches

Current transformer explosions cannot occur through careless meter testers or operators where Franklin Switches are used. They make it impossible to cut out the meters without short-circuiting the transformer secondary. That means *Safety.* Write.

PHILADELPHIA ELECTRIC COMPANY SUPPLY DEPT
132 SOUTH ELEVENTH STREET PHILADELPHIA

Make your
"Line Construction Permanent"



Here are a few views of a Power Line recently installed by the Empire Gas & Electric Company, of Auburn, New York. This Company, like all progressive Power Companies, realized the necessity of permanence in construction and used FRANKLIN STEEL POLES for their supporting structures.
If you are interested in permanent line construction, at a cost no greater than if you installed wooden poles, write us for information.

FRANKLIN STEEL WORKS, FRANKLIN, PENNA., U. S. A.

They're Unbreakable!

No lesser word can convey a true understanding of the toughness, durability and hard-service qualities of

Peirce Brackets

of hot-rolled channel steel

The heavy cross-section of the back-bone—the broad base straps slotted for extra bolts, the large, strong rivets—the rugged pins with their Peirce Spring Threads—make Peirce Brackets practically unbreakable indeed even under abnormal service strains. And the hot-dip galvanizing process prevents them from ever being weakened by corrosion.

The Hardware MAKES the line **Hubbard Makes THE HARDWARE**

HUBBARD AND COMPANY

PITTSBURGH, PA

71854 1

Enormous Stocks of Thousands of Standard Fibre Parts

THOUSANDS of bins like this—all carefully classified—contain enormous stocks of washers, insulators, junction box covers, gaskets, most thinkable kinds of cleats, switch handles, bases—every part for electrical work that must be a non-conductor. Then there are miles of tubing in a variety of diameters for conduits, flat sheets for switchboard bases—tons of them! And all this is only for initial shipments on "hurry-up" orders.

Wherever possible it is advisable for you to let us machine your fibre parts, because machining fibre is different from metal and requires—to get economical results—the sort of experience that we have gained during the last 40 years. We can give you quotations on *machined* fibre parts that will convince you that it is economical to let our machine shop work for you.

Write us for estimates on a dozen or a million pieces—no obligation whatever.

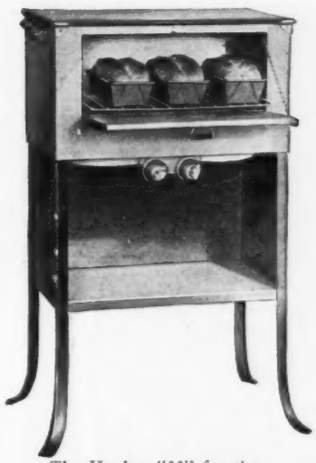
American Vulcanized Fibre Co.

535-555 Equitable Bldg., Wilmington, Delaware

AMERICAN Vulcanized Fibre

Show the Housewives in Your City How to Keep Cool!

Cooking must be done whether the thermometer is at 10 below zero or 100 in the shade. Someone in every family is going to prepare three meals a day and no one is going to suffer the heat of a coal or gas range after they've once learned of the convenience and cool comfort of



The Hughes "33" for the average family

HUGHES
Electric Ranges
Leaders in the Electric Cooking Line

The summer months are here; every housewife is dreading the exhausting heat of the kitchen range; now is the time for every dealer and central station man.

Get in touch with us while the time is ripe. A post-card brings full information and our new 52-page catalog.

Hughes Electric Heating Co.
215 W. Schiller St. Chicago, U. S. A.
Cable Address: "Hueslectro"
Canadian Factories: Toronto and Winnipeg

The Hughes "17" for the small family

The Macbeth Illuminometer

An accurate, convenient, complete and compact light measuring instrument.

As those who have had practical experience in the attempt to secure light measurements appreciate, there are many and perfectly good reasons for securing an instrument that must be first of all accurate—but must also be complete, convenient and quick in operation, compact and easy to carry.

All these requirements have been successfully combined in the MACBETH ILLUMINOMETER. An investigation will go to show those appreciating photometric devices and mechanical detail that every barrier in respect to uncertainty and inconvenience has been removed by this ingeniously developed instrument.

All the parts are there. The result—you can take a reading almost instantly. You hold a 20-oz. instrument in your hand and from a standing position at a convenient distance make the measurement either of the light incident or emitted "brightness" on a given plate or surface. As an instance, a number of readings were recently made in a large installation in five or six minutes, practically the time it would take to walk over the distance.

The range of the MACBETH ILLUMINOMETER provides a direct reading scale of from 1 to 25 foot candles. By use of neutral absorbing screens you can, if desired, take readings over the entire range from thousandths of a foot candle to many thousand foot candles. The screens make it possible to take the readings at a point of maximum sensitiveness of the eye.

All parts are conveniently assembled in a handsome leather case. Total weight, 15 to 18 pounds (varying according to type of battery used, dry cell or storage).

May we send you a bulletin in which every detail of construction and operation is given?

THE LEEDS & NORTHRUP CO.
4903 STENTON AVENUE, PHILADELPHIA

1

Every Home In Your City Is a Market for the

Thor

ELECTRIC HOME IRONING MACHINE

Does 95% of the Home Ironing

Another of the famous "Hurley Load Builders" which have done more to increase off-peak loads than any other domestic machines on the market.

Central station men and dealers can sell this machine with a few minutes demonstration because every house wife sees immediately the economy, convenience and labor-saving incident to its use.

Every house wife who has a Thor Washing Machine will see the "team work" possibilities if this Ironing Machine is added.

The Thor is simple, safe and strong. It is of the shoe type *with 25 per cent more surface* than on other machines. Ninety-five per cent of the home ironing—napkins, table cloths, sheets, underwear, etc., can be ironed at nominal cost and the drudgery is eliminated. Perfect work guaranteed no matter what the material.

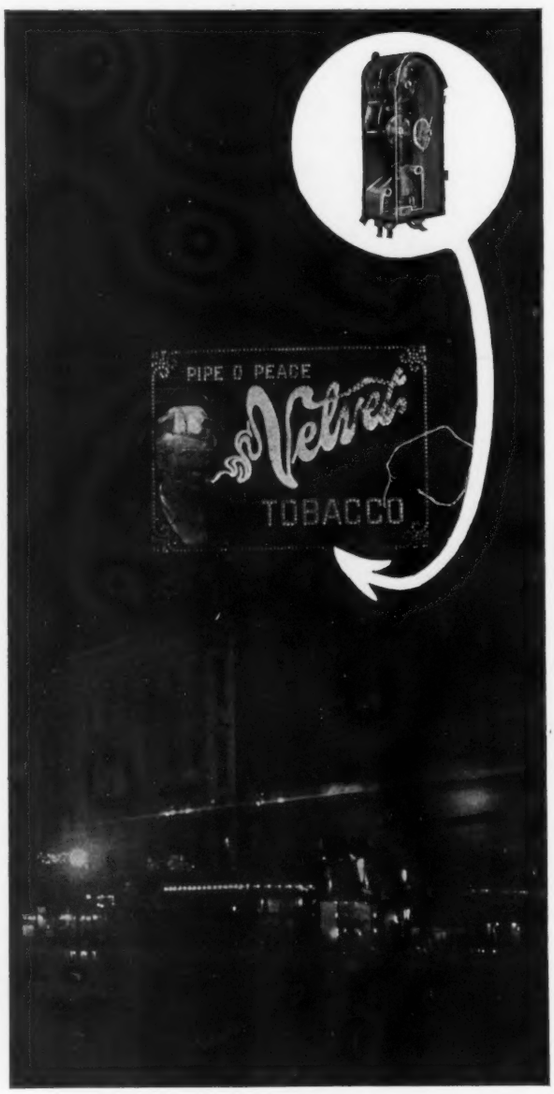
The machine is built in three sizes—38", 44" and 50"—a size for any home.

The same motor that is furnished with the Thor Washing Machine will operate the Ironing Machine.

Write for Catalogue "H" showing our complete line of washing machines, ironing machines and vacuum cleaners. Do it NOW.

Hurley Machine Company
35 So. Clinton Street, Chicago
142 W. 42nd Street, New York

Make Your Switching Time Certain with The Campbell Time Switch



Campbell Sign Combination

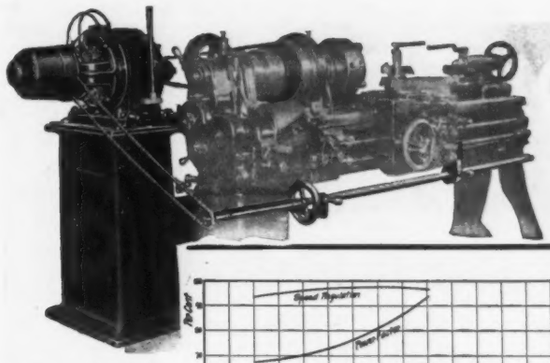
For Low Voltage Tungsten Sign Lighting
The Campbell "Lowvolt" Transformer
220/110 V. primary and 22/11 volt secondary with a
Campbell Thermo Flasher
in series with transformer primary. All controlled by a
Campbell Eight Day Time Switch
"Does all there is to do."

Campbell Electric Co., Lynn, Mass.
Stocked by Principal Jobbers

2118

Shops using Lathes, Drills and other Machine Tools will eagerly buy the

KIMBLE



Adjustable Speed Single Phase A. C. Machine Tool Motor on demonstration

You can replace engine driven line shafting in a great majority of machine shops, foundries and other tool-using plants in your a.c. territory by showing them how the Kimble Adjustable Speed A.C. Motor delivers an *infinite variety of speeds—any* desired speed, at will—by the turn of a wheel.

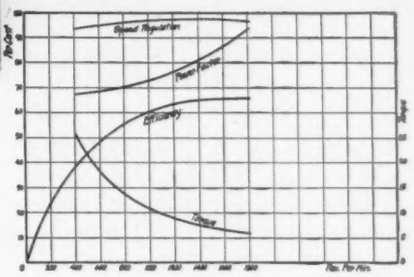
And that this motor holds its set speeds through all changes of load.

And that its output in horse power remains practically constant because torque increases as speed decreases.

And both the Central Station and the Consumer will be interested in the fact that the power factor in this a.c. motor is even greater than that of the average induction motor.

The Curves Tell the Story

Following is a typical record of a 2 h.p. Kimble Single Phase Adjustable Speed motor operated on 220 volts, with a speed range of 600 to 1800 r. p. m., delivering 2 h.p. at all speeds.



This is a series-wound motor with compensating winding to correct the power factor.

Let us send you one motor for a trial, pending your decision to undertake the sale of the entire line.

Sizes 1/6, ¼, 1/3, ½, ¾, 1, 1½, 2, 2½.

All equipped with S.K.F. Ball Bearings.

Circular on request.

13

KIMBLE MOTORS

KIMBLE ELECTRIC COMPANY, 637 N. Western Avenue CHICAGO, ILL.

Disinterested Advice

always carries conviction.

Read what the Eastman Kodak Company advises doing in case of fire around electrical apparatus.

The Pyrene Fire Extinguisher is efficient on electrical and other fires.

Pyrene Manufacturing Co.

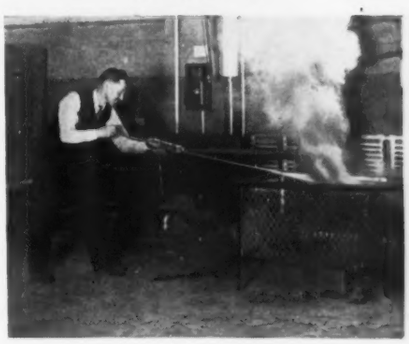
52 Vanderbilt Ave., New York

Offices in All Large Cities of the United States

DISTRIBUTORS TO ELECTRICAL TRADE: WESTERN ELECTRIC CO.
PACIFIC COAST DISTRIBUTORS: GORHAM FIRE APPARATUS CO., San Francisco, Los Angeles, Seattle.
Distributors for Canada: May-Oatway Fire Alarms, Ltd., Winnipeg, Toronto.
Distributors for Great Britain and the Continent: The Pyrene Co., Ltd., 19-21 Great Queen St., London, W. C.

"WHAT TO DO IN CASE OF ACCIDENT"

No. 7



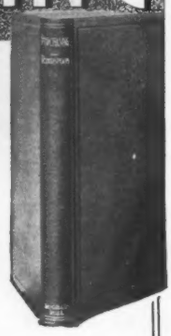
In Case of Fire Around Electrical Apparatus

Do not use water or any extinguisher that will act as a conductor of electricity. A Pyrene fire extinguisher should be used, as in the ill...

Next week's poster (No. 8) will be of special interest for the ladies

EASTMAN KODAK COMPANY
ROCHESTER, N. Y.

PURCHASING



Just Published

Sent for free examination

By **C. S. Rindsfoos, C.E.**

President of the U. S. Purchasing Corporation; formerly Secretary-Treasurer Foundation Co.

165 *pages*, 6 *x* 9, $2.00 (8/4) *net*, *postpaid.*

Modern literature has been flooded with books for the producer and his salesman, but very little has appeared for the man who buys and pays for the goods. Mr. Rindsfoos has prepared this book for the purchasing agent on the basis of a wide experience.

It covers completely and in a practical manner the important features of the subject. The principles that underlie successful purchasing are brought out and illustrated by examples from actual practice.

Every purchasing agent or buyer will find the material on forms, legal aspect of purchasing, etc., a useful guide in solving the problems of modern purchasing.

CHAPTER HEADINGS

I. How to Obtain the Right Article.
II. How to Obtain the Lowest Price.
III. How to Obtain Prompt Delivery.
IV. Making the Purchase Conform to Fixed Policy.
V. How to Obtain Favorable Terms.
VI. Personal Characteristics and Qualifications.
VII. Strategy.
VIII. Some of the Real Aspects of Purchasing.
IX. Departmental Organization.
X. Forms.

FREE EXAMINATION COUPON

McGraw-Hill Book Co., Inc.,
239 West 39th Street, New York, N. Y.

You may send me on 10 days' approval:
Rindsfoos—Purchasing, $2.00 net.
I agree to pay for the book or return it postpaid within 10 days of receipt.
....I am a regular subscriber to the Electrical World.
....I am a member of A. I. E. E.

(Signed) .....

(Address) .....

.....

Reference W-6-26

(Not required of subscribers to the Electrical World or members of A. I. E. E.)

BUDDHA

Buddhist mythology has it that Buddha crossed from Ceylon to India on a string of monkeys.

That method may have worked with Buddha, but it wouldn't be a safe trick for an ordinary mortal to try.

To try it would be equivalent to adopting for your machines a grade of brush just because it had given satisfactory service on some other machines similar to yours.

Brushes must *always* be *prescribed* for the *service* by the *brush maker.* That is why Morganite brushes *always* are successful and economical.

Specifying Morganite means a prescription of the proper grade by a competent brush engineer.

The Morgan Crucible Company Limited
116 Liberty St, New York City

Factory, Brooklyn, N. Y.

AGENTS:
Lewis & Roth Co., 312 Denckla Bldg., Philadelphia
Electrical Engineering & Mfg. Co.
First National Bank Bldg., Pittsburgh

35,000 SQUARE FEET

WORTHINGTON

Surface Condenser

One of two now being installed in the Connor's Creek Power Station of the **Edison Illuminating Company of Detroit,** each in connection with a 20,000 K.W. Curtis turbine.

In power plants in every section of the United States and in Europe—plants holding and establishing new records for economy—you will find Worthington condensers and auxiliaries.

A few of the best known plants using surface condensers are illustrated in Bulletin W-177-38. Why Worthington Condensing Apparatus is the most efficient and reliable is interestingly told in this bulletin. Write for a copy.

Henry R. Worthington

115 Broadway, New York Works: Harrison, N. J.

Branch Offices in All Principal Cities.

W282.4

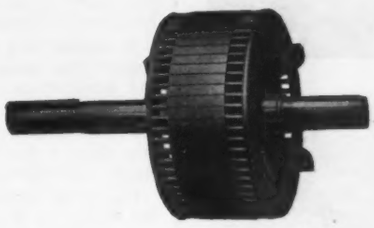
EVERY PART

of an

ALLIS-CHALMERS

Induction Motor

is Effectively Cooled



The fan-shaped arms of the rotor spider send a steady current of cooling air to every part of the motor.

The air is drawn in through the open bearing housings, is forced around the ends of the rotor winding and through the ventilating ducts.

Passing also around the ends of the stator coils and through the ducts in the core, this current of air is directed back of the stator laminations and out the large openings in the frame.

This method of *forced* ventilation is effective because the flow of air is *directed* to every part of the motor.

Write for Bulletin No. 1087

ALLIS-CHALMERS
MANUFACTURING COMPANY

Milwaukee, Wisconsin

Offices in All Principal Cities

For all Canadian Business refer to Canadian Allis-Chalmers, Ltd., Toronto, Ont., Canada

25 FACTS TO KNOW about the DIESEL TYPE ENGINE

Fact No. 14.—It is the most compact power plant.

Wherever space must be economized, either by reason of the limitations of existing buildings or on account of the high price of land or for any other cause, the McIntosh & Seymour Diesel-type engine is preëminent.

It needs only arm-room round the engine and generator: no additional space is required for boilers or any auxiliaries. Even the fuel does not demand floor space, because it can be stored in an underground tank.

From the compactness of the engine there follows also that this is the most easily supervised type of power plant. Watch can easily be kept on it by one man.

Have you studied all the other benefits derivable from the McIntosh & Seymour Diesel-type engine? Write to us and ask for our illustrated bulletins 55, 58, 59, and 60E.

McINTOSH & SEYMOUR CORPORATION

AUBURN——————NEW YORK

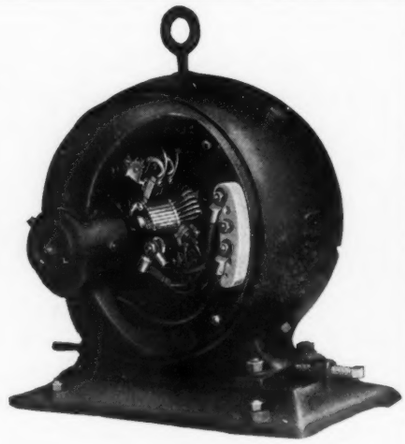
See our engines at the Panama-Pacific Exposition, San Francisco

2570

A High-Grade Motor-Driven Device?

Get the Motor to Suit

Peerless



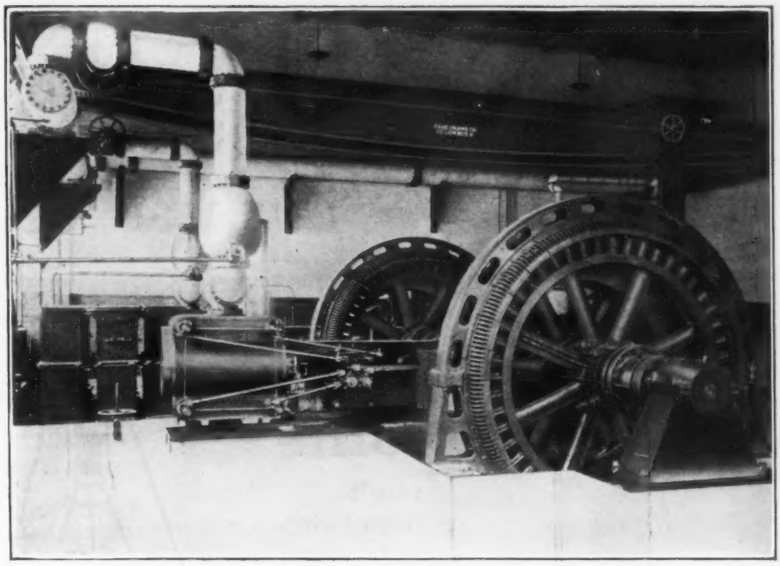
It will mean the application to your work of a motor of constant reliability — a rugged motor which is trouble-proof and represents the minimum of power consumption week in and week out.

Our exacting factory tests protect you from motor breakdown of any character. And our staff of motor building experts is ready to advise you if you have any motor-drive problems.

There is a Peerless for your service. Write us.

The Peerless Electric Co.
Dept. "M."
Warren, Ohio

High Economy—Close Regulation



Ridgway Engines of the Wilkesbarre Co., Wilkesbarre, Pa.

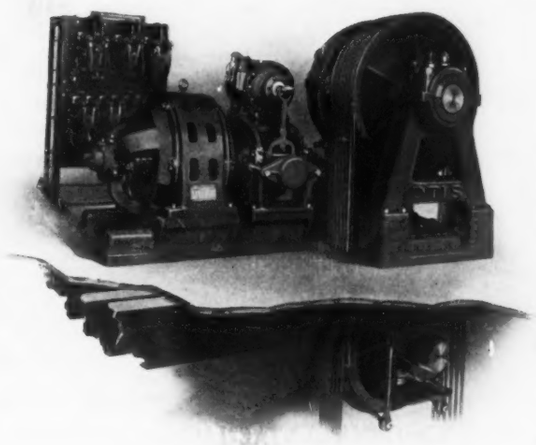
at all loads

The Ridgway Four Valve Engine

The Ridgway inertia governor keeps the regulation close, and maintains generator output at the required point without voltage changes. The Ridgway non-releasing valve gear gives a rapid cut-off equivalent to the Corliss engine performance without the defects of the Corliss, and is a builder of economy records.

Get the full facts of Ridgway Four Valve Engine practice. It is making history in reciprocating engine performances. The Ridgway Portfolio is worth while. Send for it.

Ridgway Dynamo & Engine Company
Ridgway, Pa.



The Otis Variable Speed Alternating Current Traction Elevator Machine. A development that makes possible the use of a relatively high speed elevator in Alternating Current districts.

If you generate Alternating Current

you should know about this Alternating Current Traction Elevator Machine with variable speed control, for in knowing what this machine accomplishes you will realize the impetus given to elevator development in districts laid with Alternating Current supply lines.

A useful book which pictures and describes this machine as well as all other types of Otis Electric Traction Elevators will be sent, gladly, upon request.

OTIS ELEVATOR COMPANY
Eleventh Avenue and Twenty-sixth Street, NEW YORK

Offices in All Principal Cities of the World

"Lux Lamps Last Longest"

Nitros
60 Watt up

The Standard of quality which makes "Lux Lamps Last Longest" is an assurance of long life from Lux Nitros.

Write for List and Discount
LUX MFG. CO.
HOBOKEN, N. J.
364

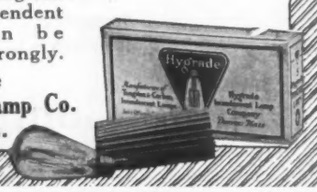
Hygrade

AMERICAN MADE—FOR THE BEST AMERICAN TRADE

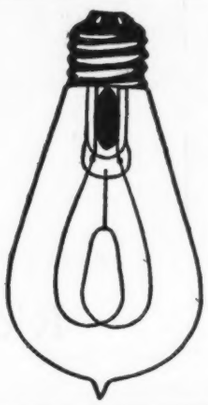
WE GUARANTEE
that the average Hygrade Tungsten Lamp has a stronger filament and will give better service than any other Tungsten Lamp.

ASK US why a Tungsten Lamp of independent manufacture can be backed up so strongly.

Hygrade Incandescent Lamp Co.
Danvers, Mass.



Increased Profits
result from Lamp purchases at the
Consolidated Electric Lamp Company
Tapleyville Station, Danvers, Mass.



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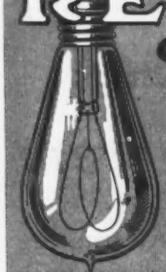
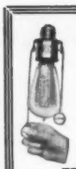
REFILLED CARBON LAMPS



Cut Down on Your Overhead Expense By Ordering Renewed Carbon Lamps from
BOSTON-ECONOMY LAMP DIVISION
NATIONAL LAMP WORKS OF GENERAL ELECTRIC COMPANY
128 MAPLE STREET - - - - - DANVERS - MASS



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Saves 80% when turned on lowest step.
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MANY DESIGNS AND PRICES RIGHT

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Imparts a snap and brilliance to lamp bulbs usually found only in natural colored glass. Satisfactory results guaranteed. Furnished in following colors: Blue, green, purple, amber, red, ruby, violet, canary, pink and frosting.

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Of Every Description
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The Semi-Indirect Lighting Unit with the Qualities of Opal Glass and the Strength of Steel
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FOR HANGING ARC LAMPS
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The Tape on the "Overhead"

Take a walk around town. Look at the feed wires on your overhead system. Notice the splices particularly. Is the taped-up portion tight and fast? Or has it loosened up, peeled—perhaps even fragmentary ends of tape are now hanging streamer-wise to the winds.

Next time you order, try WALPOLE. Walpole Tape is weather-proof—won't peel. Write for prices.

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electric irons smooth the wrinkled brow of care

Nichrome is the standardized resistor for quality heating devices.

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Look for the Diamond M

We carry a complete stock of cotton, silk and enamel magnet wire in our various warehouses throughout the country.

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Every foot is subject to critical inspection and to severe electrical tests, which ensure perfect dielectric properties, before shipment is made.

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LAVITE

Bushings and Tubes

are superior to and more accurate than can be made of any other materials.
Used by all electrical manufacturers. 6

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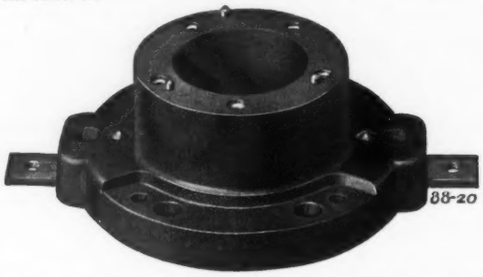

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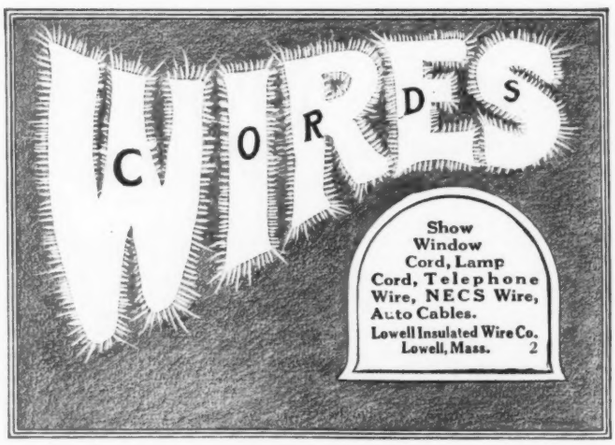

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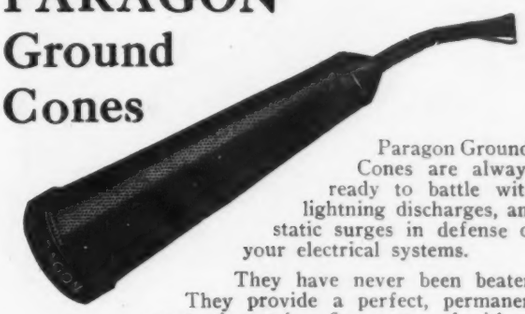
Always in Fighting Trim

PARAGON Ground Cones



Paragon Ground Cones are always ready to battle with lightning discharges, and static surges in defense of your electrical systems.

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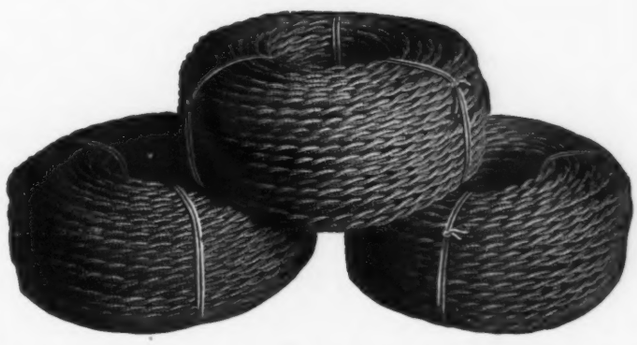

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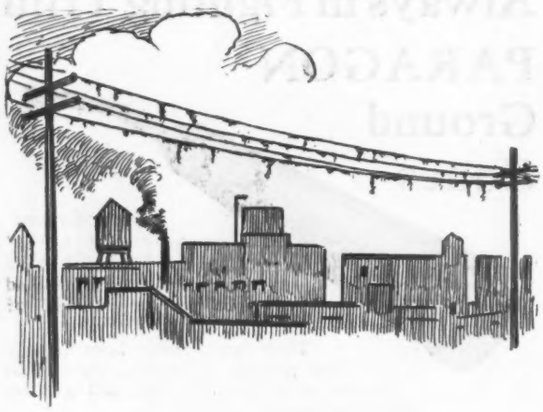

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This represents the class of insulation frequently seen on the lines.

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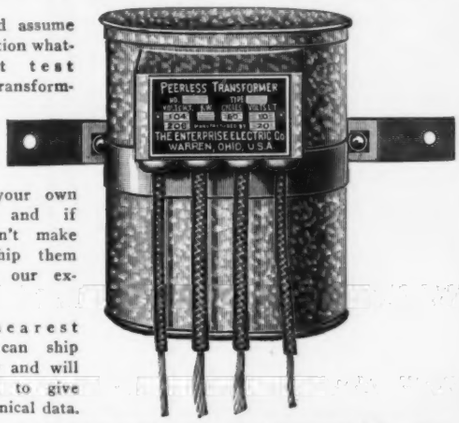
You need assume no obligation whatever—just test some transformers in your own service, and if they don't make good, ship them back at our expense.



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Transformers of all kinds, for all purposes. 3

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To secure prices give us K. W. capacity voltage, cycles, transformers required.

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Lowest dielectric constant of any Insulator.
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We are ready to prove this by a free trial on your job. 3 sizes, ⅛ to 8 in.

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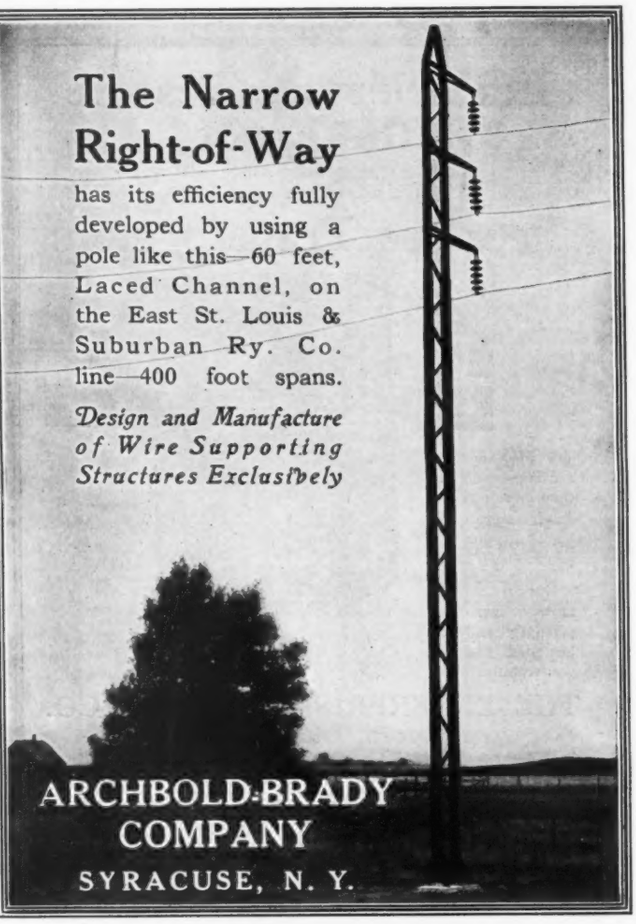
Design and Manufacture of Wire Supporting Structures Exclusively



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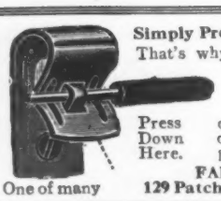

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That's why you should insist on having

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Press Down Here. on all the electrical devices you buy (without extra charge) and why manufacturers put them on their products (gratis).

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G & W Grounding Cap

Pipe Driven and Joint Made. One Operation.

It is a driving head.
No battered ends to saw off.
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Now, by the simple expedient of a slight change in the fuse tube, we have made it impossible for the fuse-wire to work loose with its expansion and contraction under current changes.
Renewal is done without any tool.
A free sample will give you the big merits of Daum in a moment. Send for it.

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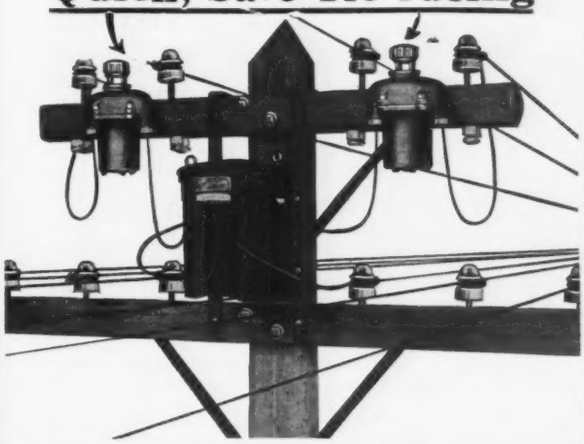

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cut the time on service interruption, protect your lineman when refusing and save your transformer from burning out.
They will open a 5000 K.W. short circuit and will perfectly safeguard your lines in doing so.
Fuse trouble will vanish from your lines the day you adopt the "D & W" Cutouts. You will get property and life protection at comparatively low cost.
Investigate NOW. Postponement may be costly.
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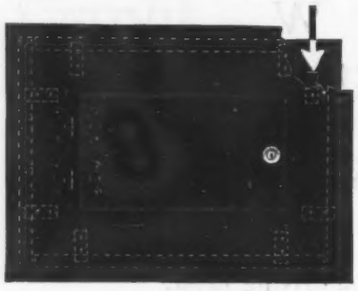

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By the use of our new swing clamp, the trim can be put in perpendicular—even though the box is out of plumb.

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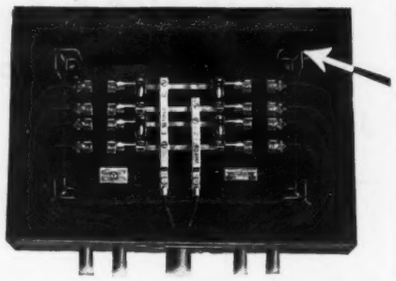
By the use of the corner irons, if a box is installed at an angle, the panel can be put in straight.

3—The Slotted Frame

By the use of the slotted frame, the wires can be run through first. Then the slotted frame can be placed over the wires.

All these boxes are equipped with knockouts and conduit hole closers.



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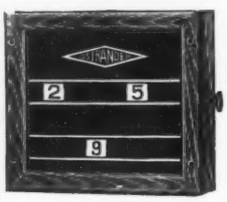

Are known for their quality.

They are built for those who want the best—with economy.

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125-250 Volts—N. E. C. Standard

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JEWEL Detachable Electric Rowboat Motor. Attaches to any rowboat, runs on 2 six-volt batteries. No odor, noise or dangerous gasoline. Complete without batteries, $75.

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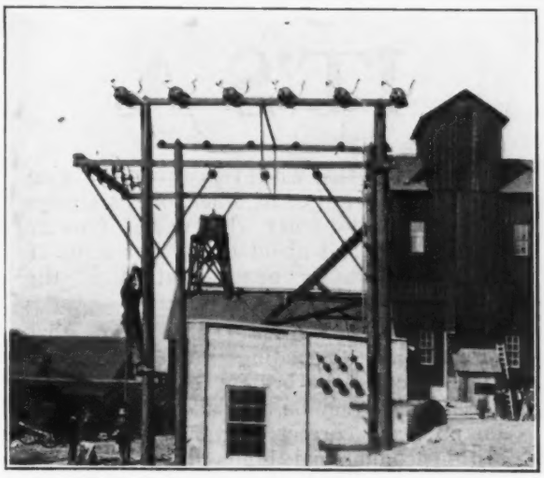

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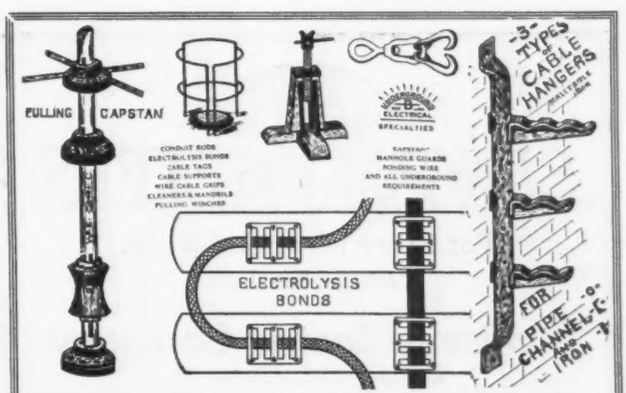

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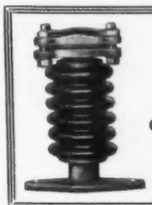

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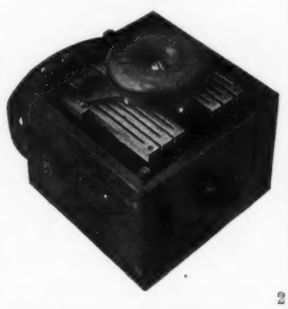

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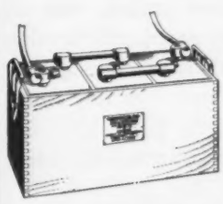

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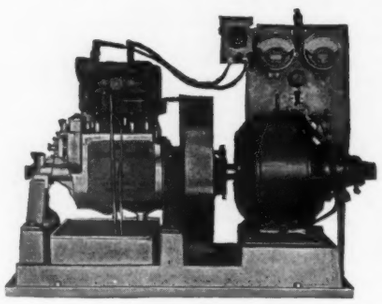

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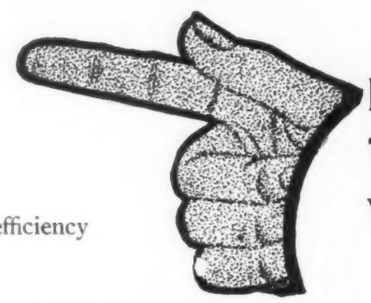

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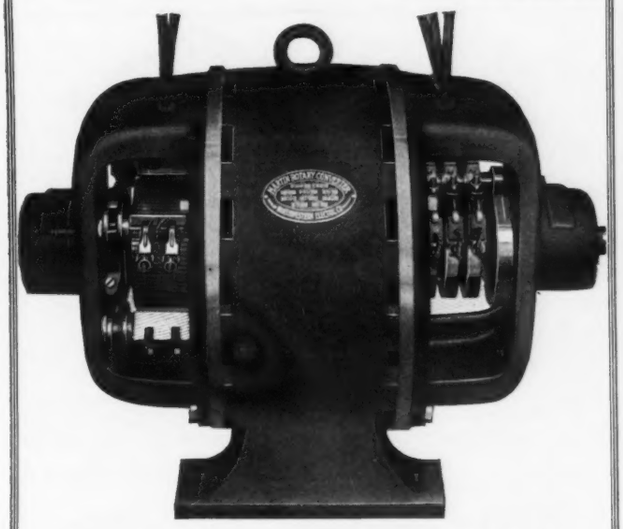

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.833	16 Ft.	188	6,140	172.80	93.07
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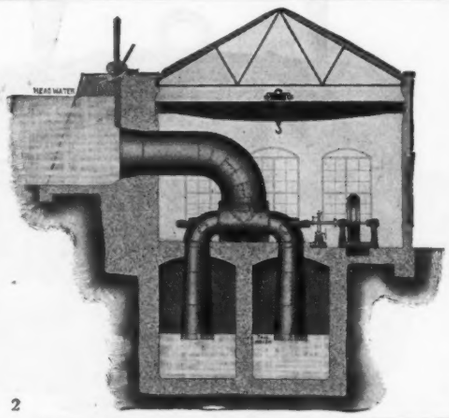

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All at Constant Speed of 514 R.P.M. Head, 267 Feet.

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for Insulating Underground Steam Heating Pipe,

and turn it into revenue instead of letting it go to waste. Big Central Stations all over the country are doing this, and find Michigan Pipe Casings indispensable. Michigan Pipe Casing is absolutely waterproof —it is tin-lined to prevent radiation and is built of the most effective non-conducting materials. *A word from you will bring particulars and prices—write!*

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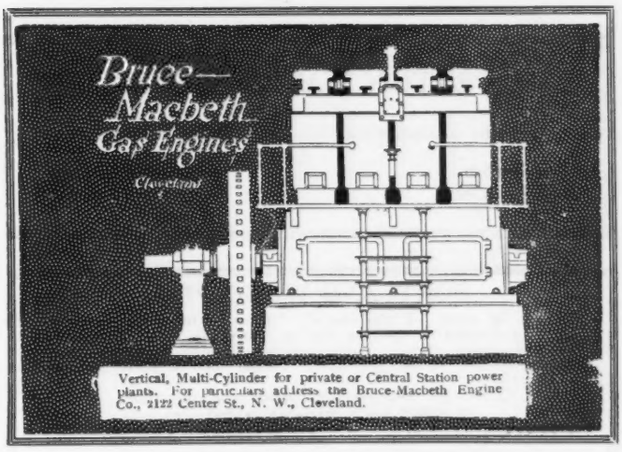

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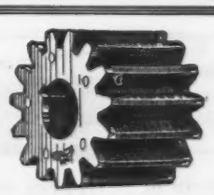

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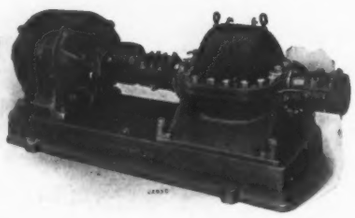

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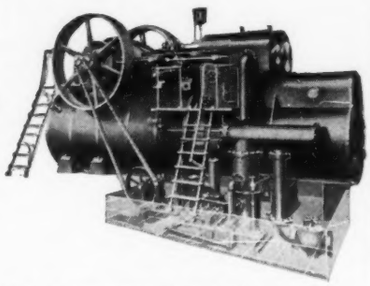

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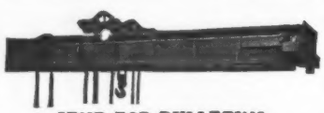

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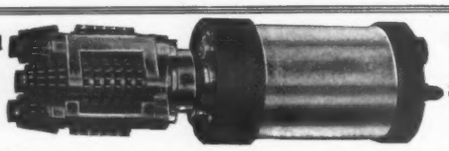

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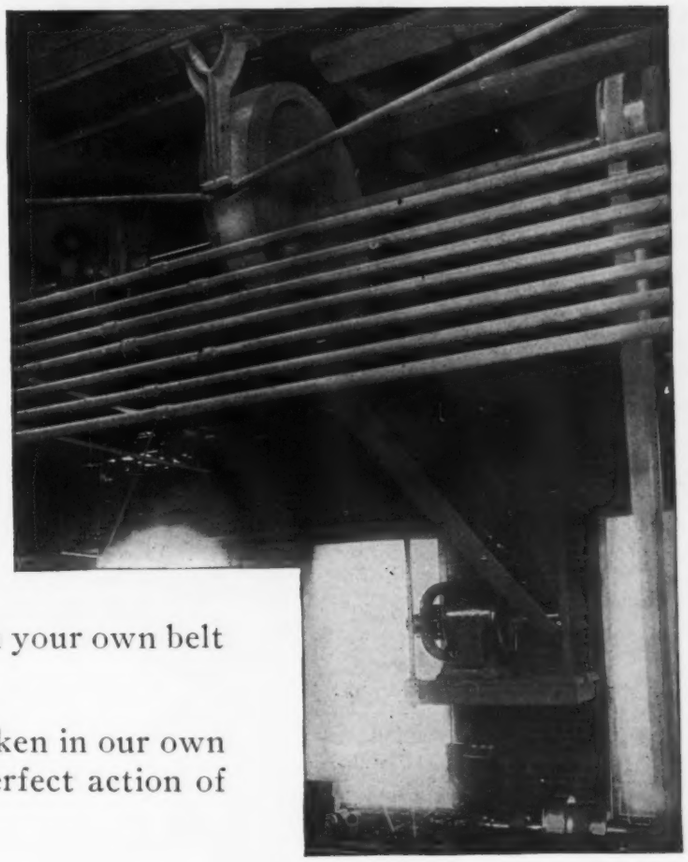

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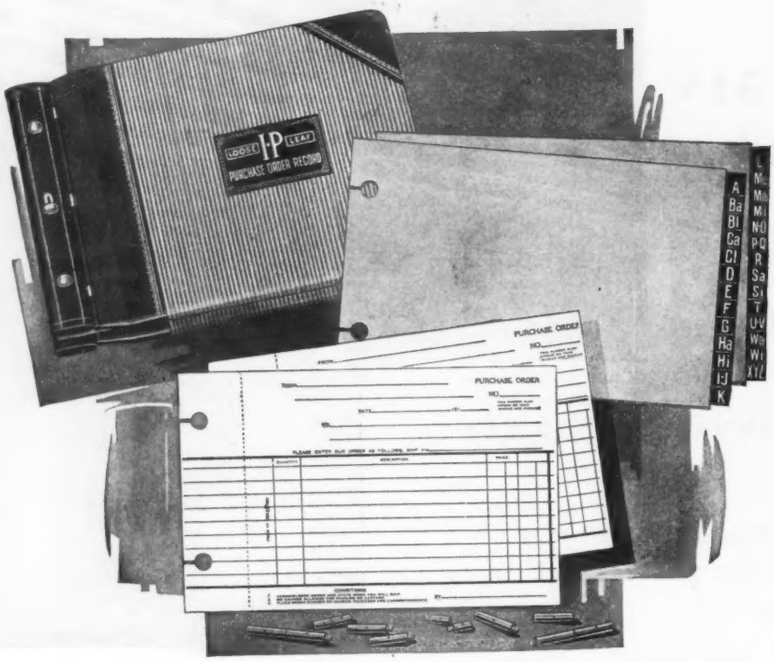

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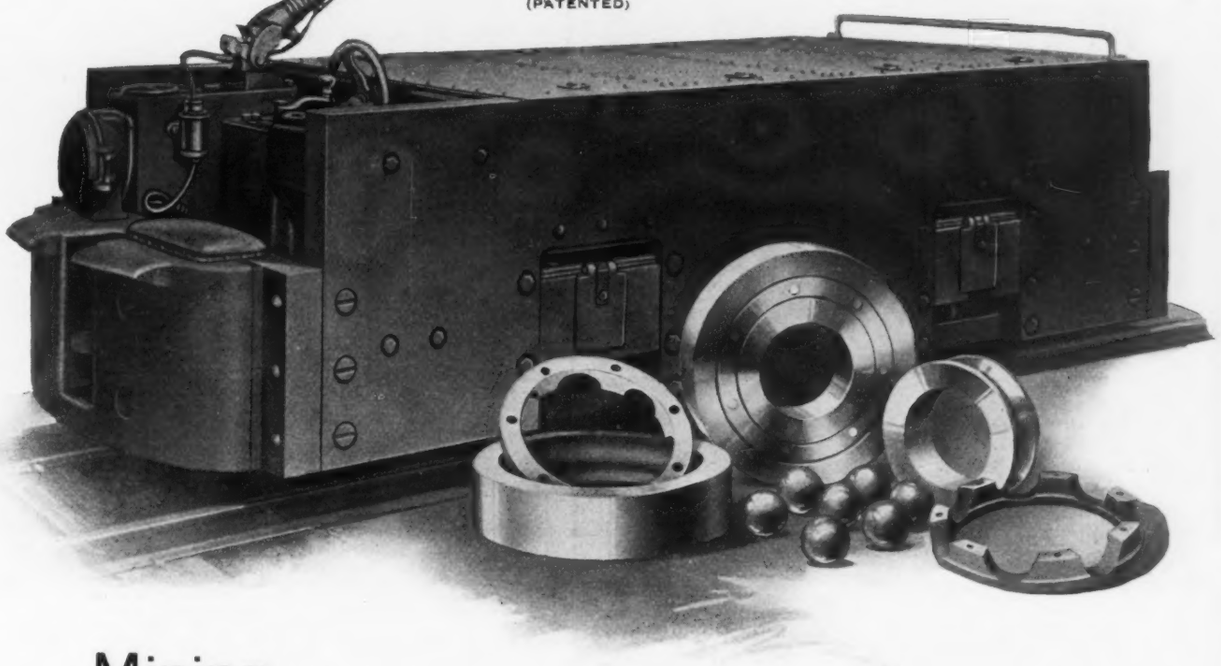

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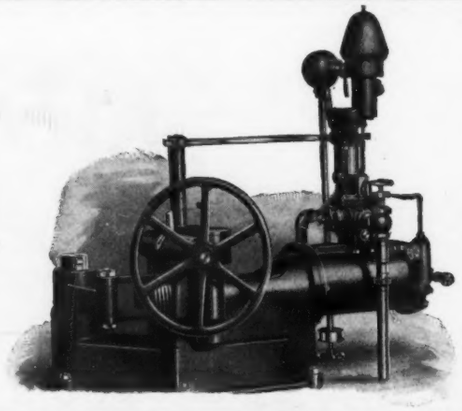

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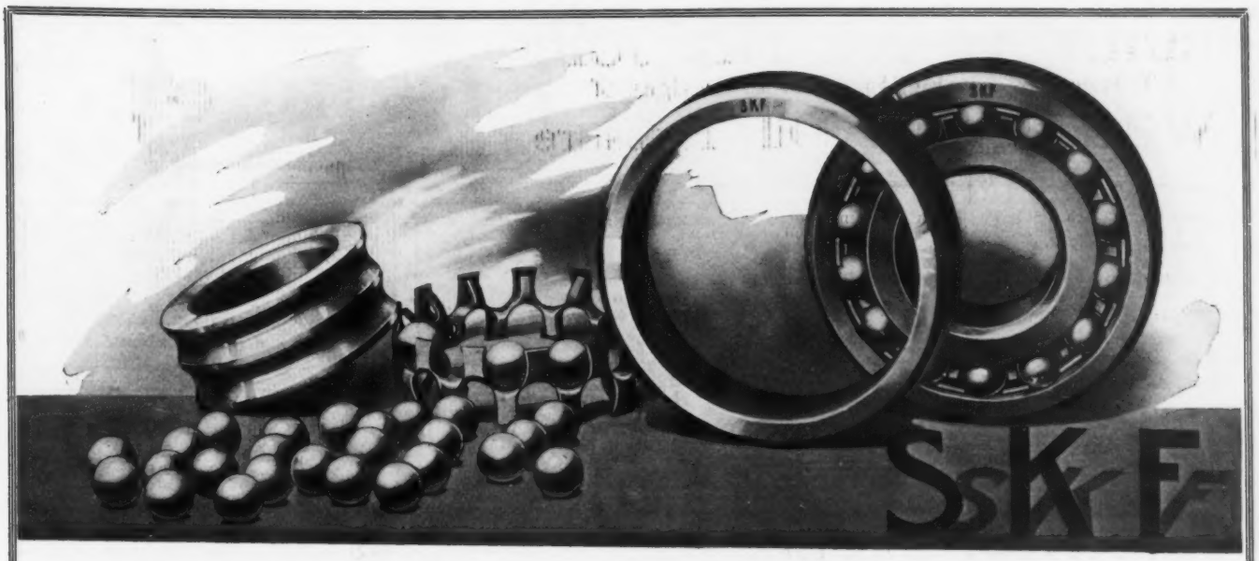

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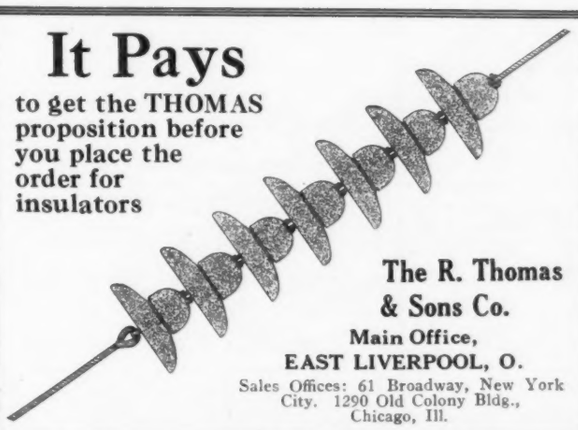

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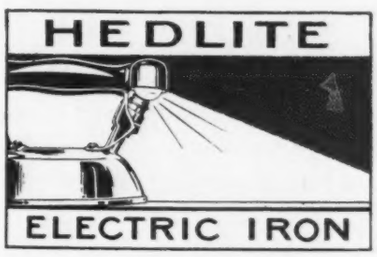

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A. C. Motors: 1/20 H. P., $9.80; 1/12 H. P., $12.90; 1/8 H. P., $14.85; 1/6 H. P., $15.75; 1/4 H. P., $18.25; 1/2 H. P., $28.75; 1 H. P., $45.50.

D. C. Generators: 6 K. W., $68; 11 K. W., $80; 15 K. W., $115; 40 K. W., $250; 60 K. W., $390.

Ask for **New List** of hundreds of special bargains—all sizes.

THE F. BISSELL CO., 233 Huron St., Toledo, O.

MACGOVERN AND COMPANY, INC.

FRANK MACGOVERN, Pres. & Gen. Mgr.

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Steel Header Water Tube Boilers

1 600 H.P. Babcock & Wilcox, 200 lbs. pressure.
1 500 H.P. Babcock & Wilcox, 200 lbs. pressure.
2 350 H.P. Babcock & Wilcox, 165 lbs. pressure.
2 250 H.P. Babcock & Wilcox, 165 lbs. pressure.

SEND FOR OUR CATALOGUE OF STEAM AND ELECTRICAL EQUIPMENT

WE HAVE FOR SALE

2—425 Kva. 2300 V. 3 phase, 60 cycle, 150 RPM, Generators, no Engines.
1—260 Kva. 220 V., 3 Phase, 60 cycle, with Buckeye simple Engine.
1—1000 KW. Mixed Pressure, and
1—1000 KW. High Pressure, Curtis Horizontal Turbines, 2300 V.
1—500 K. W. Westinghouse Parson's Horizontal, 2300 V.

Send us your wants.

EDGAR M. MOORE & COMPANY
PITTSBURGH, PA.

New and used Steam and Electrical Machinery

A Genuine Bargain

An exceptional opportunity to purchase the following steam apparatus, all in fine condition. The reason for selling—Replaced by Central Station Service:

One—315 HP., 20" x 42" Corliss Engine, Dia. of fly wheel 10', 86 R.P.M. This engine complete with steam separator, piping, etc.
One—125 HP., 72" x 16' Union Iron Works return tubular boiler. Maximum steam pressure now permissible, 125 lbs.
One—15" x 18" Ball Engine, having two fly wheels, 44" and 62" in Dia., 225 R.P.M.
One—100 HP., 60" x 16' Union Iron Works return tubular boiler. Maximum steam pressure now permissible, 90 lbs.

Also a number of smaller steam engines, feed water heaters, etc.

Write or wire for prices.

ERIE LIGHTING COMPANY
Erie, Pennsylvania

SEARCHLIGHT SECTION

ELECTRICAL AND STEAM MACHINERY FOR SALE

BELTED ALTERNATORS, 60 CYCLE

1—400 KW., Westg., rev. fld., 3-phase, 440 or 2300 V., 400 R.P.M.
1—300 KW., G. E., rev. fld., 3-phase, 60 cycle, 550 volts, 450 R.P.M.
1—200 KW., G. E., rev. fld., 3-phase, 60-cycle, 2300 volts, 600 R.P.M.
1—150 KW., G. E., form P., 3-ph., 60-cy., 480-240 volts, 600 R.P.M.
2—150 KW., G. E., rev. fld., 3-phase, 60-cycle, 2300 volts, 600 R.P.M.
1—120 KW., Westg., rev. fld., 2-phase, 60 cycle, 2300 volts, 720 R.P.M.
1— 30 K W., G. E., rev. fld., 3-phase, 60 cycle, 600 volts, 1200 R.P.M.

DIRECT CURRENT DYNAMOS

2—400 KW., Ft. Wayne compound wound engine type, 115 R.P.M., 250 volts.
1—200 KW., G. E., 8-pole, 250-volt, compound wound, 200 R.P.M., direct connected to 18 x 17 Harrisburg, 4-valve, side crank.
1—100 KW., Northern six pole, 400 R.P.M., 250 volt.
1— 75 KW., Gen'l Elec., 4 pole, 750 R.P.M., 125 volt.
1— 60 KW., Northern, 4 pole, 800 R.P.M., 125 volt.
1— 55 KW., Gen'l Elec., 4 pole, 875 R.P.M., 125 volt.

ALTERNATING CURRENT UNITS

2—500 KW., Westinghouse horizontal turbo generator sets, 60 cycle, 2300 volts, 3 phase (or 2 phase), 3600 R.P.M.
1—500 KW., G. E. Turbo set, generator being type ATB, 4-500-1800 R.P.M., 3-phase, 60-cycle, 2300-600 volts.
2—360 KVA., Rev. Field Alternator, 3-ph., 60-cy., 2300 volts, direct connected 19 & 32 x 24" Tandem McEwen engines, 150 R.P.M.
1—300 KW., Rev. Field Alternator, 3-ph., 60-cy., 440 or 2300 volts, direct connected 14 and 28 x 30" Cross Compound Allis-Chalmers engine, 150 R.P.M.
2—300 KW., G. E., rev. fld., 3-phase, 60 cycle, 2300 volts, 150 R.P.M., each direct connected to 14 & 30 x 30" Allis-Chalmers engine.
1—150 KW., G. E., rev. fld., 3-ph., 60-cy., 2300 or 480 volts, 180 R.P.M., direct connected 18 x 17 Harrisburg four-valve engine.
1—110 KW., Westg., 2-phase, 60 cycle, 440 volt, 257 R.P.M., direct connected to 14 x 14" Ball & Wood engine.

A.C. and D.C. MOTORS—Transformers all kinds

ARCHER & BALDWIN, 114-118 Liberty Street, New York
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Commonwealth Edison Company.
Repair Shops
Telephone Randolph 1280
38 North Market Street,
Chicago
Dynamos. Motors. Transformers.
Arc Lamps and Appliances
High grade machine work of all kinds
Correspondence Solicited-

HAROLD R. WILSON MACHINERY CO.
ELECTRIC & STEAM MACHINERY SECOND HAND
New Bank of Commerce Bldg., ST. LOUIS, MO.
Direct Connected D.C. Units 125-250 Volts

K.W.	Make	Volts	Poles	Sp.	Make Engine
1200	West. El.	230	18	100	32&62x48 R. & S. Vert. C. C. Cor.
500	Westge.	3 Wire	..	150	21&42x30 McL.&Sey. Hor. T. Comp.
3—400	Westge.	250	10	150	18&36x30 Tand. Comp. 4 Valve.
375	Allis	125	..	100	19&34x36 Nordberg Vert. C. C. Cor.
350	Ridgway	275	..	150	26x28 Ridgway Heavy Duty
350	Cr.-Wh.	250	12	130	24x33 Buckeye R. H. Eng.
250	Westge.	3 Wire	..	150	16&31x27 Erie City Tand. Comp.
2—220	Gen. El.	275	8	210	1-24x20 Erie; 1-27x18 Ball & W.
200	Gen. El.	250	..	200	Westge. Gas Eng. 3 Cyl. Vert.
200	Westge.	3 Wire	..	200	17&28x20 Ridgway H. T. C.
160	Gen. El.	3 Wire	..	225	18&14x23 Ridgway Tand. C.
2—150	Westge.	3 Wire	..	160	1 Comp. Erie; 1 Comp. Ridgeway
4—125	Gen. El.	250	4	2400	Curtiss Hor. Steam Turb.
100	West. El.	250	6	250	15x14 Chuse 4 ported Auto.
100	Triumph	250	6	250	Ideal Hor. Tand. Comp.
2—	75 C.-W.	250	..	275	15x12 Harrisburg Engines
75	Gen. El.	250	..	2400	Curtis Hor. Non-Cond. Turb.
35	Gen. El.	250	..	3600	Curtis Hor. Steam Turbine
20	Triumph	125	4	340	8x9 Chuse Auto. Simple

ENGINES, BOILERS, A.C. & D.C. MOTORS, GENERATORS
This is only a partial list, send for complete one.

WANTED

Immediate Delivery

Frequency Changer Set

Capacity 500 K.W. to 1000 K.W., 25 cycle, three-phase motor, 13,200 volts, 60 cycle, three-phase generator, 13,200 volts. Speed 300 R.P.M.

W. S. Barstow & Co., Inc.
50 Pine St.
New York City

SPECIALS

220-250 VOLTS, D.C.

K.W.	Make.	Type.	Speed.	Price.
150	General Electric	CLB	500	$700
150	General Electric	3 wire	580	700
85	Westinghouse	S	750	450
75	Northern	MP	600	350
30	Westinghouse	S	950	175
20	Western Electric	MP	950	150
13	Crocker Wheeler	CCD	900	125
50	Sprague generator, direct connected Harrisburg engine			800

110-125 VOLT, D.C.

K.W.	Make.	Speed.	Price.
37½	Westinghouse	550	$175
25	Westinghouse	1100	150
20	General Electric	1200	150
17	Westinghouse S	1125	140
11¼	Westinghouse S	1200	110
3¾	Westinghouse S	1000	60
100	C & C. dir. con. Erie engine,		750
50	Crocker Wheeler dir. con. Ball & Wood engine.		650
30	General Electric dir. con. Allis engine		450

A.C. (3 PHASE, 60 CYCLE, 220 VOLT).

K.V.A.	Make.	Type.	Speed.	Price.
150	Westinghouse	——	900	$750
125	General Electric	ATB	900	750
100	Fairbanks	RF	900	550
75	Bullock	RF	1200	550
175	General Electric type "ATB," 2300-1100 volt dir. con. Atlas, 4 valve engine			1,650

OIL ENGINES

70 H.P. De La Vergne twin cylinder oil engine $1,500.
De La Vergne, 35 H.P., $700; 20 H.P., $350; 15 H.P., $275.

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Du zets & Son
Hudson Terminal Building, New York

SEARCHLIGHT SECTION

FOR SALE

Generator for Sale

For Sale—1½ K.W. D.C. generator with rheostat and voltmeter, good as new; 2 horsepower G. E. 1-phase A.C. motor, 110-220 volt, type R1, nearly new; 10x12 Atlas engine, good as new; 2-ton Wizard refrigerating machine, in good condition. Schulenburg Light and Ice Co., Schulenburg, Texas.

Generating Set for Sale

One—37½ KW. Westinghouse Generator, 110 volt, 300 amp., 250 RPM, direct connected to Westinghouse, 2-cylinder Gas Engine, used one year. Will guarantee; can demonstrate. Price $1,000 f.o.b. cars Pittsburgh, Pa. City Engineering Co., 619 Ferguson Building, Pittsburgh, Pa.

Interest in Lighting Company

For Sale—One-third interest in an electric light company doing good business, in town of 1200 inhabitants in Oklahoma. Must increase capacity of plant. For particulars address Box 374, Elec. World, 1570 Old Colony Bldg., Chicago, Ill.

Engines and Generator for Sale

One 100 H.P. 3 cylinder Weber gas engine. One 65 H.P. 3 cylinder Foos Gas engine. One 75 K.W. 3 wire D.C. generator, 275 rev. One Gas producer. One 80 H.P. 4 cylinder Lawson Oil Engine. 220 volt Storage Battery. All in good running order, some almost new. F. Paustian Milling Co., Brillion, Wis.

Engine and Generator for Sale

17 K.W. Westinghouse, 3-wire D. C. generator, 110-220 volts, direct connected to Fairbanks 2-cylinder gas or gasoline engine, complete with switchboard, meters, etc. Having been used just six months. In good condition. Will sell cheap. J. M. Doll, Shreveport, Louisiana.

Arc Lamps for Sale

75 or more Fort Wayne Wood, form C series direct current enclosed arc, street arc lamps, for 5 or 5.5 amperes. 50 or more General Electric, form 3 twin carbon (Narragansett), 2.75 to 3 ampere enclosed arc lamps for multiple service across 220 volt direct current circuits. All just as they are, as taken in from service, with some glassware if desired. South Norwalk Electric Works, South Norwalk, Conn.

Business for Sale

Electrical Supply and Contracting Business, worth $3,500, will sell for $2,500 at Boulder, Colorado. For further information address L. A. Vosmer, Boulder, Colorado.

Wattmeters for Sale

A few new Type C, 60 cycle Westinghouse wattmeters, 10, 20, 40, 80 ampere sizes single phase; also a few rebuilt meters in first class condition, 5 and 10 ampere sizes. Box 358, Elec. World.

Motor for Sale

For Sale—One 50 H.P. motor, 500 volt D.C., 400 R.P.M., $130. A bargain. We have no use for the motor. Falcon Mfg. Co., Big Rapids, Mich.

Dynamos, Engines, Boilers

Two 133 cycle dynamos, burned out, easily repaired; good five-ton ice plant; one 75 horse power Ideal piston valve Springfield stationary engine and 90 H.P. boiler, new flues, and one Cocran feed water heater. Box 355, Elec. World.

Belted Generator for Sale

For Sale—One D. L. C. 6-125-650, 125/250 volt compound wound commutating pole, 3-wire D.C. belted generator complete, with pulley, sub-base, rheostat and 3-wire parts for 25% unbalanced current in neutral. Capacity 125 K.W. Machine was installed December, 1914. Has operated less than two months. Regarding price address Chas. A. Olson, Treasurer, 35 Congress St., Boston.

Westinghouse Motor for Sale

For Sale—One 4 H.P. 220 volt D.C. compound wound, Westinghouse motor. Write William G. Reuter, Cincinnati, Ohio.

FOR SALE

For Sale

Enameled steel flat shades 18 inch—3¼ inch holders, 60 cents; also tape ends at $11 per hundred. Rubber splice, 20 cents per lb. Send for bargain list. Charles G. Robin, 48 Warren St., New York City.

BUSINESS OPPORTUNITIES

Capital and Services

Small investment and services are offered by electrical engineer, 30, exceptional ability and experience. State full particulars. Box 342, Elec. World.

Good Investment

A reliable party wanted to invest in an electrical manufacturing business, near New York, with or without taking an active part in management of same. Good opportunity for the right party. References required. Box 343, Elec. World.

Part Interest

An exceptionally good opportunity is offered for an electrical engineer having $5,000 to $10,000 to invest to secure an interest in the business of one of the oldest concerns engaged in electric wiring construction in New York City. A young man with experience in estimating and soliciting work would best meet the requirements. Address Box 366, Elec. World.

MISCELLANEOUS WANTS

Wanted to Buy

Electric light and power plant in prosperous town of 1800 to 3500, situated in New York, Pennsylvania, Maryland or New England. Give complete reports regarding equipment, operation, franchise and contracts in first letter. Also name best price and terms. Box 365, Elec. World.

Catalogs Wanted

Mr. Ruddick, manager and engineer of the Stadacona Hydraulic Company, has made his headquarters at Beaupre, P. Q., and will be glad to receive catalogs from manufacturers and merchants addressed to him there.

Generator Set Wanted

Second-hand 300 K.W. Turbo Generator Set with exciter, 2300 volt, 60 cycle, 3 phase, 150 lb. steam pressure condensing Also surface condenser with air and circulating pumps for fresh injection water.

All must be in good running order. State where may be inspected and quote price, with full particulars.

Box 361, Electrical World

PROPOSALS

TREASURY DEPARTMENT, SUPERVISing Architect's Office, Washington, D. C., June 21, 1915.—Sealed proposals will be opened in this office at 3 p. m., July 21, 1915, for the installation complete of an electric passenger elevator in the United States marine hospital at Port Townsend, Wash., in accordance with the drawings and specification, copies of which may be had at this office in the discretion of the Supervising Architect. JAMES A. WETMORE, Acting Supervising Architect. N. B.—Bidders are required to return the drawings and specification without marks, notes, or other mutilations. The Government frank sent to intending bidders is to be used for the return of the drawings and specification and for no other purpose.

PROPOSALS

Bids open July 9, 1915.

NOTICE TO CONTRACTORS

ELECTROLIER SYSTEM

EMMETSBURG, IOWA

Sealed proposals for the furnishing of the necessary material and labor for the installation of an electrolier system in the city of Emmetsburg, Iowa, will be received at the office of T. F. Rutledge, Emmetsburg, Iowa, up to 9:00 A. M. on July 9, 1915, at which time they will be opened. All proposals shall be addressed to T. F. Rutledge, Secretary of the Street Lighting Committee of the Emmetsburg Commercial Club.

Separate proposals will be entertained as follows:

1. For supplying all electroliers; complete with glassware and electric fittings.

2. For supplying all electroliers; iron or steel columns only.

3. For supplying glassware and electric fittings for electroliers.

4. For supplying all cable, foundations and accessories; erecting electroliers and connecting same so as to make an operating system.

5. For supplying cable and connecting lamps on traffic monuments to main electrolier system.

6. For supplying all cable and necessary accessories for complete installation, excepting concrete foundations and proposals Nos. 1 and 5 eliminated therefrom.

Plans and specifications can be seen at the office of T. F. Rutledge, Emmetsburg, Iowa, at the office of the Aetna Engineering Bureau, 17 North LaSalle St., Chicago, Ill., or at the office of the undersigned engineer.

Complete sets of plans and specifications will be furnished intending bidders, for their convenience, on the deposit of $5.00 with the engineer; which deposit will be returned when a bid is submitted in accordance with this notice and the plans and specifications are returned.

The Lighting Committee reserves the right to reject any and all bids.

T. F. RUTLEDGE, Secy.,
Emmetsburg, Iowa.

ARTHUR H. FORD, Engineer,
Iowa City, Iowa.

TREASURY DEPARTMENT, SUPERVISing Architect's Office, Washington, D. C., June 15, 1915.—Sealed proposals will be opened in this office at 3 p. m., July 15, 1915, for a hydraulic lift at the United States Treasury Building, Washington, D. C., in accordance with this specification, copies of which may be obtained at this office in the discretion of the Supervising Architect. JAS. A. WETMORE, Acting Supervising Architect. N. B.—Bidders are required to return specification without marks, notes, or other mutilations thereon. The Government frank sent to intending bidders is for the return of the specification and for no other purpose.

TREASURY DEPARTMENT, SUPERVISing Architect's Office, Washington, D. C., June 16, 1915.—Sealed proposals will be opened in this office at 3 p. m., July 14, 1915, for the installation complete of an electric freight elevator, hoistway, etc., in the United States post office, courthouse, etc., at Baltimore, Md., in accordance with the drawing and specification, copies of which may be had at this office in the discretion of the Supervising Architect. JAS. A. WETMORE, Acting Supervising Architect. N. B.—Bidders are required to return the drawing and specification without marks, notes, or other mutilations. The Government frank sent to intending bidders is to be used for the return of drawing and specifications and for no other purpose.

SEARCHLIGHT SECTION

POSITIONS WANTED

CABLE engineer, with several years' experience in laying and maintenance of rubber insulated submarine cable, desires suitable position. Also trained in telegraph, telephone and instrument lines. Age 38; M. E.-Assoc. A. I. E. E. Address Box 348, Elec. World.

COMMERCIAL engineer of wide experience and proven ability selling electric power and motors, on both steam and water power systems; first class reference. Box 300, Elec. World.

ELECTRIC light and power superintendent desires a position in a city of 4,000 or less. Central States preferred. Address Elbie Soice, Stafford, Kansas.

ELECTRICAL engineer wishes position as chief electrician or superintendent. Six years' experience with all kinds of electrical apparatus and construction. Can increase electrical sales and efficiency of plant and employees. Technical graduate, associate member A. I. E. E. Steady and industrious. Can give good references. Box 302, Elec. World.

ELECTRICAL engineer, technical education, 12 years' experience, generation, steam turbine plants, transmission, distribution for factory and maintenance, interurban railways. Last 4 years operation and maintenance heavy freight electric service. Would make change about July 1st. Will go anywhere. Address Box 234, Elec. World.

ELECTRICAL graduate, 26, Boston Tech.; four years' experience; employed; will sacrifice salary for experience. References and not afraid of work. Box 299, Elc. World.

ELECTRICAL engineer, technical graduate, age 28, five years' experience designing, estimating, constructing and operating of power and light installations. Speaks Spanish, French, German and Dutch. Best of references furnished. Desire position as office or field engineer anywhere. Can accept position at once. Box 364, Elec. World.

ELECTRICAL engineer desires a position in field work, preferably in South America. Seven years' experience in power station design, testing and inspection. Reliable, efficient, and possesses initiative. At present employed. Box 363, Elec. World.

ELECTRICAL engineer with executive ability, technical graduate, associate member A. I. E. E., desires position with good future. Experience includes research work for large electrical manufacturing company, testing department work with largest central station company, three years in charge distribution and meter department in city of 100,000. At liberty July 1. Box 357, Elec. World.

ELECTRICAL engineer, university graduate, 2½ years' experience with installation and testing of D.C. and A.C. motors, generators and insulating materials, desires position as assistant engineer with power or manufacturing concern. Box 388, Elec. World.

ELECTRICAL engineer, technical graduate, 15 years' practical experience with General Electric, Westinghouse and public utility companies in engineering, construction and operation, age 36, married, A1 references. Box 386, Elec. World.

ELECTRICAL engineer desires a position as instructor or assistant professor in electrical engineering in a medium sized college or technical school. Broad technical education with three years of practical experience in engineering work and two years of successful teaching experience. Associate member A. I. E. E. Can give first class references. Box 360, Elec. World.

ELECTRICIAN, twelve years' sound all around experience on construction, maintenance, repairs, wants permanent position as chief electrician in some factory or as foreman. Box 381, Elec. World.

ELECTRICIAN and steam engineer, sixteen years' experience power house, line construction and maintenance, inside wiring, all branches. Box 333. Elec. World.

ELECTRICIAN, wireman, thoroughly understands inside construction in all its details. Plans, specifications, layout and estimate. Desires job, middle part New York State preferred. Box 390, Elec. World.

EX-CHIEF electrician, United States Navy, desires position. Nine years' experience in all branches of trade. Age 26 years. Technical education. Expert on D.C. motor installation and maintenance, storage battery systems, etc. Can go anywhere. Box 345, Elec. World.

POSITIONS WANTED

EXPERIENCED, capable man wants position as superintendent, engineer or works foreman where practical ability, sobriety, honesty and ability to make good and get results will be of value. Not a technical graduate, but well informed theoretically and abreast of the times in all practical phases of his work. Twenty-five years continuous experience in operation and management electric and water plants, steam and water power. Will work for moderate salary and consider any location. Gilt edge references. Box 369, Elec. World.

EXPERIENCED electrical and mechanical draftsman, college graduate, desires position with light and power company or manufacturing concern. Box 389, Elec. World.

FACTORY executive or engineer (M. E.-Assoc. A. I. E. E.), age 38, with long and varied experience in the development, design and manufacture of mechanical and electrical specialties, instruments, etc., wishes responsible position. New York preferred. Address Box 347, Elec. World.

GERMAN electrical engineer and draftsman, good character, neat appearance. ten years' experience in shop and office, desires position anywhere. English and German perfect. Salary $30. Box 380, Elec. World.

LADY bookkeeper-cashier wants better position. Thoroughly experienced, accurate, efficient, tactful, courteous. Six years with municipal electric and water plant, two years with gas company. Stenographer and typist. Fine penman. Best references. Box 370, Elec. World.

MANAGER and superintendent of electric light and power plant desires change; twelve years' experience, honest, reliable and ambitious; salary reasonable. Box 351, Elec. World.

OPERATING engineer, technical, 13 years' operating and managing power plants, transmission lines, distribution systems and the commercial application of electric power. Energetic; a good organizer and business better. Box 344, Elec. World.

POSITION wanted as superintendent or manager electric light, power, or water plant where sobriety, ability and long experience in all phases of the business will be appreciated. Box 301, Elec. World.

POSITION as superintendent or manager of small hydro or steam electric plant. Fifteen years' experience. Can produce results. Box 362, Elec. World.

SUPERINTENDENT of electrical construction in New York wishes to locate with good concern. Seventeen years' experience, estimator, solicitor. Willing to locate anywhere. Box 393, Elec. World.

SUPERINTENDENT or foreman, employed, married, 30 years of age, two years' college education, thirteen years' practical experience, wiring, testing and installing motors, switchboards, etc. Correspondence solicited. Box 330, Elec. World.

TRAINED electrician would invest $600 and his services in a reliable small electrical concern in any line. Understands elevator, pumps, etc. Speaks Spanish. Very honest man, good habits and hard worker. Box 391, Elec. World.

YOUNG electrician, twenty-four, three years' experience, Bliss graduate, desires a position with some company where he can learn some branch of electrical engineering. Box 379, Elec. World.

WANTED—Position as traveling auditor or would consider position where could work up to same; 12 years' experience as bookkeeper and office work, with some auditing experience. Can furnish best of references. Salary no object. Box 382, Elec. World.

POSITIONS VACANT

FIRST class mechanical designer wanted with experience on electrical apparatus. Application should state age, education, experience in detail, whether married or single and salary expected. Apply "Chief Draftsman," Wagner Electric Mfg. Co., St. Louis, Mo.

POSITIONS VACANT

SUPERINTENDENT wanted for electric light company within 50 miles of New York City. Give experience and education, salary expected, age and nationality. Must be a live wire and a hard worker. Current purchased. Box 368, Elec. World.

WANTED—Young man for stenography and general office work with electric light company within 20 miles of New York City. Box 367, Elec. World.

EMPLOYMENT AGENCIES

AMERICAN SERVICE COMPANY, General Engineering Agency, Pittsburgh, Penna., solicits confidential employment records of available Electrical, Power and Industrial Engineers, Master Mechanics, Designers, Electricians, Business, Sales and Accounting Executives for general proposals to employing authorities. Vacancy Notices and Opportunities solicited everywhere and records submitted to employers for approval and without obligations.

EDUCATIONAL

BLISS ELECTRICAL SCHOOL, Washington, D. C.—Condensed Course in Electrical Engineering, complete in one year. Thorough, practical, scientific. Theoretical and applied electricity, mathematics, mechanical drawing and necessary engineering training. No superficial or non-essential studies. Actual construction, installation and testing. For young men of energy and character. Twenty-third year opened Sept. 22. Write for catalogue. Address 129 Takoma Ave.

METERMEN WANTED to enroll for complete practical course of "Electrical Measuring Instruments and Meters." Endorsed by leading electrical men. Write for booklet, "Instruments and Meters," giving full information. Fort Wayne Correspondence School, 913 Shoaff Bldg., Fort Wayne, Ind.

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ROSE POLYTECHNIC INSTITUTE, Terre Haute, Indiana.—A college of engineering; courses in mechanical, electrical, civil, architectural and chemical engineering. Extensive shops, well-equipped laboratories in all departments, expenses low; 32nd year. For catalogue containing full information and professional register of alumni, address C. L. Mees, President.

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by Representative Manufacturers and Dealers

Accountants.
Greims Corp., H. E.

Air Compresors.
Allis-Chalmers Mfg. Co.
Platt Iron Works.

Aluminum.
Aluminum Co. of America.

Ammeters, Voltmeters.
(See Instruments, Electrical.)

Anchors, Guy.
Matthews & Bro., W. N.

Annunciators.
Ostrander & Co., W. R.

Asbestos, Wood.
Johns-Manville Co., H. W.

Ball Bearings.
Hess-Bright Mfg. Co.
Norma Co. of America.
S K F Ball Bearing Co.

Batteries, Dry Cell.
Jewel Elec. Co.
Johns-Manville Co., H. W.
Nungesser Carbon & Battery Co.
Philadelphia Elec. Co. Supply Dept.

Batteries, Primary.
Manhattan Electrical Supply Co.

Batteries, Storage.
Electric Storage Battery Co.
General Lead Batteries Co.

Battery Connections.
Fahnestock Electric Co.

Bells.
Manhattan Elec'l Supply Co.
Ostrander & Co., W. R.

Binding Posts.
Fahnestock Electric Co.

Boilers.
Babcock & Wilcox Co.
Edge Moor Iron Co.

Bolts, Expansion.
Hubbard & Co.

Books, Technical.
McGraw-Hill Book Co., Inc.

Boosters.
C & C Elec. & Mfg. Co.
Crocker-Wheeler Co.
General Electric Co.
Ridgway Dynamo & Engine Co.
Westinghouse Elec. & Mfg. Co.

Boxes, Fuse.
G & W Electric Specialty Co.
General Electric Co.
Johns-Manville Co., H. W.
Matthews & Bro., Inc., W. N.
Metropolitan Eng'g Co.

Boxes, Junction and Outlet.
D & W Fuse Co.
G & W Electric Specialty Co.
Johns-Manville Co., H. W.
Sprague Electric Works.

Boxes, Meter and Service.
Johns-Manville Co., H. W.
Metropolitan Eng'g Co.

Brackets, Pins, Etc.
Deal Lumber Co., L. K.

Brackets and Pins, Metal.
Hubbard & Co.
Pittsburgh Transformer Co.

Brushes, Dynamo.
Jeandron, W. J.
Morgan Crucible Co., Ltd.

Building Steel.
Blaw Steel Cons. Co.

Bushings.
Condit Electrical Mfg. Co.
Diamond State Fibre Co.

Cable End Bells.
Elec'l Engineering Equip. Co.
G & W Electric Specialty Co.

Cable Racks.
Brocklen Underground Elec'l Mfg. Co.
Cope, T. J.
Metropolitan Eng'g Co.

Cable Splicing Joints.
Matthews & Bro., Inc., W. N.

Cabling Machinery.
American Ins. Machinery Co.
New England Butt Co.
Torrington Mfg. Co.

Car Heaters, Elec.
Simplex Elec. Heating Co.

Carbon Brushes.
Morgan Crucible Co.

Castings.
Pittsburgh Valve, F. & C. Co.

Chandeliers.
Benjamin Elec. Mfg. Co.

Circuit Breakers.
Condit Electrical Mfg. Co.
Cutter Co., The.
General Electric Co.
Industrial Controller Co.
Sangamo Elec. Co.
Ward Leonard Electric Co.
Westinghouse Elec. & Mfg. Co.

Clamps, Ground Connection.
Belden Mfg. Co.

Clamps, Guy.
Matthews & Bro., Inc., W. N.

Cleats.
Blake Signal & Mfg. Co.
Colonial Sign & Ins. Co.
Imperial Porcelain Co.
Star Porcelain Co.
Thomas & Sons Co., R.

Climbers.
Klein & Sons, Mathias.

Clips, Cable.
Matthews & Bro., Inc., W. N.

Clips, Testing.
Mueller & Co., R. S.

Clusters.
Adam Elec. Co., Frank
Benjamin Electric Mfg. Co.
Hubbell, Inc., Harvey

Coils, Armature, Field.
D & W Fuse Co
Independent Lamp & Wire Co.

Coils, Choke.
General Electric Co.

Commutators, Truing.
Jordan Bros., Inc.

Compounds, Commutator.
McLellan Co., K.

Condensers.
Platt Iron Works.
Worthington, Henry R.

Conduit Bends.
Fibre Conduit Co.

Conduit Cutting Machines.
Borden Co., The.

Conduit Rods.
Brocklen Underground Elec'l Mfg. Co.
Cope, T. J.

Conduit Fittings.
Sprague Electric Works.

Conduits, Interior.
American Circular Loom Co.
Sprague Electric Works.

Conduits, Underground.
Fibre Conduit Co.
Gest, G. M.
Johns-Manville Co., H. W.
Michigan Pipe Co.

Connections and Terminals.
Elec'l Engineers Equip. Co.

Contact Points.
Cleveland Tungsten Products Co.

Controllers
Crocker-Wheeler Co.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Industrial Controller Co.
Monitor Controller Co.
Simplex Elec. Heating Co.
Ward Leonard Electric Co.
Westinghouse Elec. & Mfg. Co.

Conveying Machinery. (Coal, Ashes, Etc.)
Green Engineering Co.
Otis Elevator Co.

Cord Adjusters.
American Vul. Fibre Co.
Diamond State Fibre Co.

Cord, Arc Lamp.
Samson Cordage Works.

Cord, Flexible.
American Electrical Works.
Belden Mfg. Co.
Rome Wire Co.

Cord, Trolley.
Samson Cordage Works.

Couplings, Flexible.
Bruce-Macbeth Engine Co.

Crane, Motors.
Crocker-Wheeler Co.
Sprague Electric Works.
Westinghouse Elec. & Mfg. Co.

Cranes, Traveling.
Maris Bros.

Cross Arms.
Deal Lumber Co., L. K.
Thomas & Sons Co., R.

Cutouts.
D & W Fuse Co.
G & W Electric Specialty Co.
Metropolitan Eng'g Co.

Dies.
Col's Die, Tool & Machine Co.

Drills, Brick.
Hubbard & Co.

Dynamos and Motors.
Allis-Chalmers Mfg. Co.
C & C Elec. & Mfg. Co.
Century Electric Co.
Crocker-Wheeler Co.
Electro-Dynamic Co.
Emerson Electric Mfg. Co.
Fort Wayne Electric Works
General Electric Co.
Gregory Electric Co.
Jewel Elec. Co.
Kimble Electric Co.
Lincoln Elec. Co.
Northwestern Elec. Co.
Peerless Elec. Co.
Reliance Elec. & Eng. Co.
Ridgway Dynamo & Engine Co.
Robbins & Myers Co.
Sprague Electric Works.
Wagner Electric Mfg. Co.
Westinghouse Elec & Mfg. Co.

Electromagnets.
Acme Wire Co.
Cutler-Hammer Mfg. Co.
Elec. Controller & Mfg. Co.
Sundh Electric Co.

Elevators, Elec.
Otis Elevator Co.

Engineers, Consulting.
(See Directory of Engineers.)

Engineers' Contracting.
(See Directory of Engineers.)

Engines, Gas and Gasoline.
Allis-Chalmers Mfg. Co.
Bruce-Macbeth Engine Co.
Carlisle & Finch Co.
General Electric Co.
Strelinger Co., Chas. A.

Engines, Oil.
Lyons Atlas Co.
McIntosh & Seymour Corp.

Engines, Steam.
Allis-Chalmers Mfg. Co.
Buckeye Engine Co.
McIntosh & Seymour Corp.
Ridgway Dynamo & Engine Co.

Experimental Apparatus.
Biddle, James G.

Fan Motors.
Adams-Bagnall Elec. Co.
Century Elec. Co.
Crocker-Wheeler Elec. Co.
Emerson Electric Mfg. Co.
Fort Wayne Electric Works.
General Electric Co.
Peerless Elec. Co.
Robbins & Myers Co.
Sprague Electric Works.
Westinghouse Elec. & Mfg. Co.

Fans (Exhaust and Ventilating).
Adams-Bagnall Elec. Co.
Crocker-Wheeler Co.
Emerson Elec. Mfg. Co.
Kimble Elec. Co.
Robbins & Myers Co.
Sprague Electric Works.
Westinghouse Elec. & Mfg. Co.

Fibre.
American Vul. Fibre Co.
Continental Fibre Co.
Diamond State Fibre Co.
Fibre Conduit Co.
Johns-Manville Co., H. W.

Field Coil Pads.
Mass. Chemical Co.
Walpole Tire & Rubber Co.

Financial.
Coal & Iron National Bank.
Electric Bond & Share Co.

Fire Extinguishers.
Pyrene Mfg. Co.

Fixtures, Electric and Gas.
Adam Electric Co., Frank.
Adams-Bagnall Elec. Co.
Benjamin Elec. Mfg. Co.
Johns-Manville Co., H. W.

Flashers.
Campbell Electric Co.

Friction Tape and Cloths.
Johns-Manville Co., H. W.
Massachusetts Chem. Co.
Walpole Tire & Rubber Co

Fuses.
Condit Electrical Mfg. Co.
D & W Fuse Co.
Daum Co., A. F.
Delta Star Elec. Co.
Economy Fuse & Mfg. Co.
General Electric Co.
Johns-Manville Co., H. W.
Metropolitan Eng'g Co.
Multi-Refillable Fuse Co.
Railway & Indus. Eng'g Co.

What Advertisers Offer to Readers

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Fuses, Refillable.
Daum Co., A. F.
Economy Fuse & Mfg. Co.
Johns-Manville Co., H. W.
Multi-Refillable Fuse Co.

Fuse Boxes.
(See Boxes, Fuse.)

Gauges, Recording.
Bristol Co.
Foxboro Co., The.

Gauges, Water Column.
Jenkins Bros.

Gears.
Diamond State Fibre Co.
New Process Gear Corp.

Glass.
Brooke, Homer.

Globes, Shades, Etc.
Adams-Bagnall Elec. Co.

Grounds, Etc.
Paragon Elec. Co.

Guards, Inc., Lamp.
Hubbell, Inc., Harvey.
Matthews & Bro., Inc., W. N.

Hair Dryers.
Shelton Elec. Co.

Hangers, Cable.
Condit Electrical Mfg. Co.
Matthews & Bro., Inc., W. N.

Heaters, Feed Water.
Platt Iron Works.

Heating Devices, Electric.
Amer. Ironing Machine Co.
Cutler-Hammer Mfg. Co.
General Electric Co.
Hughes Electric Heating Co.
Pittsburgh Electric Specialties Co.
Simplex Elec. Heating Co.
Westinghouse Elec. & Mfg. Co.

Heating, Steam.
American District Steam Co.

Hoists, Electrical and Steam.
Allis-Chalmers Mfg. Co.
Maris Bros.
Otis Elevator Co.
Sprague Electric Works.

Hydraulic Machinery.
Platt Iron Works.
Worthington, Henry R.

Ice Machines.
Carbondale Machine Co.

Igniters, Gas Engine.
Carlisle & Finch Co.

Indicators, Speed.
Biddle, James G.

Injectors.
Jenkins Bros.

Instruments, Electrical.
Graphic.
Biddle, James G.
Bristol Co.
Esterline Co.
General Electric Co.
Keystone Electrical Inst. Co.
Sangamo Elec. Co.
Westinghouse Elec. & Mfg. Co.
Indicating.
Fort Wayne Electric Works.
General Electric Co.
Keystone Electrical Inst. Co.
Pignolet, L. M.
Wagner Elec. Mfg. Co.
Westinghouse Elec. & Mfg. Co.
Weston Electrical Instr. Co.
Integrating.
Biddle, James G.
Duncan Electric Mfg. Co.
General Electric Co.
Sangamo Electric Co.
Westinghouse Elec. & Mfg. Co.
Scientific and Testing.
Biddle, James G.
Esterline Co.
Keystone Electrical Inst. Co.
Leeds & Northrup Co.
Matthews & Bro., Inc., W. N.
Metropolitan Eng'g Co.

Insulating Cement.
Massachusetts Chem. Co.
Walpole Tire & Rubber Co.

Insulating Machinery.
American Ins. Machinery Co.
New England Butt Co.

Insulating Material.
China and Porcelain.
Colonial Sign & Ins. Co.
Imperial Porcelain Works.
Locke, Fred. M.
Locke Insulator Mfg. Co.
Pittsburgh H. V. Ins. Co.
Star Porcelain Co.
Thomas & Sons Co., R.
Compounds, Paints and Varnishes.
Condensite Co. of America.
Diamond State Fibre Co.
Dickinson Mfg. Co.
Electric Cable Co.
General Electric Co.
Hemming Mfg. Co.
Massachusetts Chemical Co.
Mica Insulator Co.
Packard Elec. Co.
Walpole Tire & Rubber Co.
Composition Cloth and Paper.
Diamond State Fibre Co.
Massachusetts Chem. Co.
Mica Insulator Co.
Walpole Tire & Rubber Co.
Fibre.
Amer. Vulcanized Fibre Co.
Continental Fibre Co.
Diamond State Fibre Co.
Johns-Manville Co., H. W.
Massachusetts Chem. Co.
Walpole Tire & Rubber Co.
Lava.
Steward Mfg. Co., D. M.
Mica.
Mica Insulator Co.
Tape.
American Electrical Works.
Diamond State Fibre Co.
Johns-Manville Co., H. W.
Massachusetts Chem. Co.
Mica Insulator Co.
New York Insulated Wire Co.
Packard Elec. Co.
Walpole Tire & Rubber Co.

Insulating Paper.
Diamond State Fibre Co.

Insulators.
China, Porcelain and Composition.
Colonial Sign & Ins. Co.
Imperial Porcelain Works.
Johns-Manville Co., H. W.
Locke, Fred M.
Locke Insulator Mfg. Co.
Mica Insulator Co.
Pittsburgh High Volt Ins. Co.
Star Porcelain Co.
Thomas & Sons Co., R.
Glass.
Brookfield Glass Co.
Hemingray Glass Co.
Locke, Fred M.
Locke Insulator Mfg. Co.

Insulator Clamps.
Elec'l Engineers Equip. Co.

Insulator Pins.
Thomas & Sons Co., R.

Ironing Machines.
American Ironing Machine Co.

Irons, Soldering.
Simplex Elec. Heating Co.

Isolated Power Plants.
Strelinger Co., Chas. A.

Jig and Fixture Work.
Col's Die, Tool & Machine Co.

Lamp Guards.
Hubbell, Inc., Harvey.

Lamps, Arc.
Adams-Bagnall Elec. Co.
Fort Wayne Electric Works.
General Electric Co.
Westinghouse El. & Mfg. Co.

Lamps, Coloring.
McGill Mfg. Co.

Lamps, Flaming Arc.
General Electric Co.
Westinghouse El. & Mfg. Co.

Lamps, Incandescent.
Boston Economy Lamp Div.
Cons. Elec. Lamp Co.
General Electric Co.
Hygrade Incandescent Lamp Co.
Independent Lamp & Wire Co.
Lux Mfg. Co.
Philadelphia Elec. Co. Supply Dept.

Lamps, Miniature.
General Electric Co.

Lamps, Portable.
Adam Elec. Co., Frank

Lamps, Replacers.
Matthews & Bro., Inc., W. N.

Lava.
(See Insulating Material, Lava.)

Lighting Companies.
Commonwealth Edison Co.

Lightning Arresters.
Delta Star Elec. Co.
General Electric Co.
Railway & Indus. Eng'g Co.
Westinghouse El. & Mfg. Co.

Line Material.
Anderson Mfg. Co., A. & J. M.
Archbold-Brady Co.
Elec'l Engineers Equip. Co.
G & W Elec. Specialty Co.
General Electric Co.
Johns-Manville Co., H. W.
Matthews & Bro., Inc., W. N.
Westinghouse El. & Mfg. Co.

Linemen's Tools.
(See Tools, Linemen.)

Linemen's Shields.
Matthews & Bro., Inc., W. N.

Loose Leaf Binders.
Irving-Pitt Mfg. Co.

Magnet Wire.
Acme Wire Co.
American Brass Co.
American Steel & Wire Co.
Belden Mfg. Co.
Benedict & Burnham Mfg. Co.
D & W Fuse Co.
Independent Lamp & Wire Co.
Rome Wire Co.

Magnets.
Acme Wire Co.

Magnets, Lifting.
Cutler-Hammer Mfg. Co.
Elec. Controller & Mfg. Co.

Magnets, Permanent.
Esterline Co.

Mechanical Stokers.
Riley Stoker Co., Ltd., Sanford

Medical Apparatus.
Manhattan Elec'l Supply Co.
Pignolet, L. M.

Meter Testers.
States Company.

Mica.
Mica Insulator Co.

Mining Machinery.
Allis-Chalmers Mfg. Co.
Crocker-Wheeler Co.

Motors.
(See Dynamos and Motors.)

Moulded Insulations.
Cutler-Hammer Mfg. Co.
Dickinson Mfg. Co.

Name Plates.
Crowe Name Plate & Eng'g Co.

Nippers and Pliers.
Klein & Sons, Mathias.

Novelties, Electric.
Carlisle & Finch Co.

Oil, Cylinder.
(See Lubricants.)

Operators Public Utilities.
Light & Development Co., St. Louis.

Packing.
Jenkins Bros.

Panel Boards.
Adams-Bagnall Elec. Co.
General Electric Co.
Trumbull Elec. Mfg. Co.
Westinghouse El. & Mfg. Co.

Patent Attorney.
Andrews, E. J.
Howe, Thomas.

Penstock.
Portland Wood Pipe Co.

Photometer Standards.
Elec'l Testing Laboratories.

Pinions, Rawhide.
New Process Gear Corp.

Pipe.
Michigan Pipe Co.
Portland Wood Pipe Co.

Pipe Cutters.
Borden Co., The.

Pipe Locators.
Matthews & Bro., Inc., W. N.

Platinum.
Baker & Co., Inc.

Plugs.
Condit Electrical Mfg. Co.
Hubbell, Inc., Harvey.

Pole Erectors.
Matthews & Bro., Inc., W. N.

Pole Line Hardware.
Hubbard & Co.
Matthews & Bro., Inc., W. N.

Poles.
Deal Lumber Co., L. K.

Poles, Arc Lamp.
Elec. Railway Equip. Co.
King Foundry Co.

Poles, Re-Enforcing.
Hubbard & Co.

Poles, Steel.
Archbold-Brady Co.
Blaw Steel Cons. Co.
Diamond Steel Pole Co.
Franklin Steel Works.

Porcelain Specialties.
Peru Elec. Co.

Porcelain. (See Insulating Material, China and Porcelain)

Potentiometers.
Biddle, James G.
Leeds & Northrup Co.

Potheads.
Colonial Sign & Insulator Co.
Elec'l Engineers Equip. Co.
G & W Elec. Specialty Co.
Okonite Co., The

Protective Devices.
Metropolitan Eng'g Co.

Pulleys.
Rockwood Mfg. Co.

Pumps, Air.
Goulds Mfg. Co.
Platt Iron Works.

Pumps, Centrifugal.
Allis-Chalmers Mfg. Co.
Goulds Mfg. Co.
Platt Iron Works.
Worthington, Henry R.

Pumps, Electric.
Fort Wayne Engr'g & Mfg. Co.
Goulds Mfg. Co.
Platt Iron Works.
Worthington, Henry R.

Pumps, Oil.
Goulds Mfg. Co.
Ludlow Valve Mfg. Co.
Platt Iron Works.
Worthington, Henry R.

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Platt Iron Works.

Pumps, Vacuum.
Goulds Mfg. Co.
Platt Iron Works.
Worthington, Henry R.

Pumps, Water Works.
Platt Iron Works.

Push Buttons.
Manhattan Elec'l Supply Co.

Pyrometers.
Bristol Co., The.
Esterline Co.
Keystone Electrical Inst. Co.

Rail Bonds.
American Steel & Wire Co.
Condit Electrical Mfg. Co.
General Electric Co.
Roebling's sons Co., J. A.

Railways, Miniature.
Carlisle & Finch Co.

Receptacles (See Sockets).

Rectifiers.
General Electric Co.

Reflectors.
Adam Elec. Co., Frank.
Adams-Bagnall Elec. Co.
General Electric Co.
Johns-Manville Co., H. W.

Refrigerating Machines.
Carbondale Machine Co.

Repairing.
Commonwealth Edison Co.
Gregory Electric Co.

Resistance Units.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Industrial Controller Co.
Simplex Elec. Heating Co.
Ward Leonard Electric Co.
Wirt Co.

Resistance Wire.
(See Wires, Resistance.)

Rheostats.
Biddle, James G.
Campbell Electric Co.
Crocker-Wheeler Co.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Industrial Controller Co.
Monitor Controller Co.
Simplex Elec. Heating Co.
Sundh Electric Co.
Ward Leonard Elec. Co.
Westinghouse Elec. & Mfg. Co.

Rosettes.
Hart Mfg. Co.

Searchlights.
Carlisle & Finch Co.
Esterline Co.
General Electric Co.

Second-hand Apparatus.
Archer & Baldwin.
Bissell & Co.
Duzets Sons.
Gregory Electric Co.
Jordan Bros., Inc.
Lippman & Bro., H.
MacGovern & Co.
Sachsenmaier & Co., Geo.
Wilson Machinery Co.

Shade Holders.
Adams-Bagnall Elec. Co.
Hubbell, Inc., Harvey.

Shades, Tin.
Ostrander & Co., W. R.

Signs.
Colonial Sign & Ins. Co.

Signs, Electric.
Colonial Sign & Ins. Co.

Slate.
Davis Slate & Mfg. Co.
Portland-Monson Slate Co.

Sleeving, Braided.
Belden Mfg. Co.

Sockets and Receptacles.
Benjamin Elec. Mfg. Co.
General Electric Co.
Hart Mfg. Co.
Hubbell, Inc., Harvey.
Johns-Manville Co., H. W.
Ostrander & Co., W. R.
Union Electric Co.

Sockets, Turndown.
General Electric Co.
Wirt Co.

Solder.
Belden Mfg. Co.

Soldering Flux.
Blake Signal & Mfg. Co.
Condit Electrical Mfg. Co.

Solenoids.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Industrial Controller Co.
Sundh Electric Co.
Ward Leonard Electric Co.

Special Machinery.
Torrington Mfg. Co.

Speedometers.
Keystone Elec'l Inst. Co.

Splicing Compounds.
Mass. Chemical Co.
Walpole Tire & Rubber Co.

Springs.
American Steel & Wire Co.
Cary Spring Works.
Cook Spring Co.

Stage Lighting Apparatus.
Campbell Electric Co.
Condit Electrical Mfg. Co.

Staples.
American Steel & Wire Co.
Blake Signal & Mfg. Co.

Starters.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.

Stokers.
Edge Moor Iron Co.
Green Eng'g Co.
Riley Stoker Co., Sanford.

Stoves, Electric.
Cutler-Hammer Mfg. Co.
General Electric Co.
Hughes Electric Heating Co.
Simplex Elec. Heating Co.

Stranding Machinery.
Torrington Mfg. Co.

Sub-Stations, Outdoor.
Railway & Indus. Eng'g Co.

Supplies (Electric Railway).
General Electric Co.
Johns-Manville Co., H. W.

Supplies, Electrical.
General Electric Co.
Manhattan Elec. Supply Co.
Philadelphia Elec. Co. Supply Dept.
Union Electric Co.

Switchboard Mats.
Mass. Chemical Co.
Walpole Tire & Rubber Co.

Switchboard Supplies.
Condit Electrical Mfg. Co.
Elec'l Engineers Equipment Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Switchboards.
Allis-Chalmers Mfg. Co.
Anderson Mfg. Co., A. & J. M.
Condit Electrical Mfg. Co.
General Electric Co.
Trumbull Elec. Mfg. Co.
Wagner Elec. Mfg. Co.
Westinghouse Elec. & Mfg. Co.

Switches, Automatic Time.
Anderson Mfg. Co., A. & J. M.

Switches, Disconnecting.
Anderson Mfg. Co., A. & J. M.

Switches, Fuse.
General Electric Co.
Matthews & Bro., Inc., W. N.

Switches, Knife.
Anderson Mfg. Co., A. & J. M.
Condit Electrical Mfg. Co.
Cutter Co., The
Electric Controller & Mfg. Co.
General Electric Co.
Metropolitan Eng'g Co.
Trumbull Elec. & Mfg. Co.
Westinghouse El. & Mfg. Co.

Switches, Oil.
Condit Electrical Mfg. Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

Switches, Pole Top.
Delta-Star Elec. Co.
Elec'l Engineers Equip. Co.
General Electric Co.
K-P-F Elec. Co.
Railway & Indus. Eng. Co.

Switches, Remote Control.
Anderson Mfg. Co., A. & J. M.
General Electric Co.
Hart Mfg. Co.
Sundh Elec. Co.

Switches, Series.
G & W Elec. Specialty Co.

Switches, Snap and Push Button.
Cutler-Hammer Mfg. Co.
General Electric Co.
Hart Mfg. Co.
Perkins Elec. Switch Mfg. Co.
Trumbull Elec. Mfg. Co.

Switches, Time.
Campbell Electric Co.
Paragon Electric Co.

Tachometers.
Biddle, James G.
Bristol Co., The.
Esterline Co.
Foxboro Co., The.
Keystone Elec'l Inst. Co.

Taps and Dies.
Carpenter Tap & Die Co., J. M.

Telephones.
Manhattan Elec'l Supply Co.

Testing Apparatus.
American Transformer Co.
Biddle, James G.
Esterline Co.
Keystone Electrical Inst. Co.
Leeds & Northrup Co.
Matthews & Bro., Inc., W. N.

Testing Laboratories.
Elec. Testing Laboratories, Inc.

Theatre Dimmers.
Cutler-Hammer Mfg. Co.
General Electric Co.
Industrial Controller Co.
Simplex Elec. Heating Co.
Ward Leonard Electric Co.

Thermometers.
Bristol Co., The.
Foxboro Co., The.
Keystone Electrical Inst. Co.
Leeds & Northrup Co.

Tools, Construction.
Klein & Sons, Mathias.

Tools, Linemen's.
Klein & Sons, Mathias.

Towers, Transmission.
Archbold-Brady Co.
Blaw Steel Cons. Co.
Coombs, R. D.
Transmission Engr'r Co.

Transformers.
Adams-Bagnall Elec. Co.
Allis-Chalmers Mfg. Co.
American Transformer Co.
Campbell Electric Co.
Crocker-Wheeler Co.
Duncan Elec. Mfg. Co.
Enterprise Elec. Co.
Fort Wayne Electric Works
Kuhlman Elec. Co.
Metropolitan Eng'g Co.
Moloney Elec. Co.
Packard Elec. Co.
Pittsburgh Transformer Co.
Wagner Elec. Mfg. Co.
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Weston Electrical Inst. Co.

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Printing begins on Saturday of each week.
Changes of copy received up to 10 A. M. Saturday will appear in the issue of the following week, but no proofs can be submitted for OK before publication.
New Advertisements (not changes of copy) received up to Tuesday noon can appear in the issue of that week, but no proofs can be shown.
If proofs before printing are required changes of copy and copy for new advertisements must be in our hands two weeks in advance of the date of publication.

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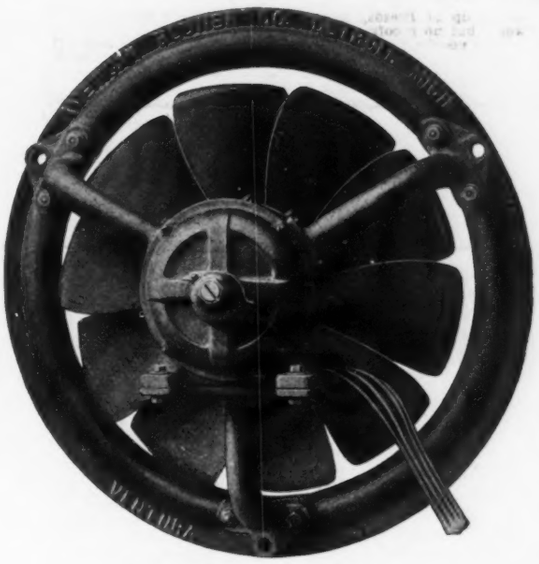

Westinghouse Ventura Fan

Every Moving Picture Theatre Must Have Artificial Ventilation

THE comfort of patrons of moving picture theatres demands an ample supply of fresh air, and in many places proper ventilation is enforced by law.

Westinghouse-Ventura Fans form the most satisfactory means of supplying this large and ever increasing demand because of their quiet operation, great reliability and high efficiency.

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Paint Shops
Theatres

We not only supply an extensive line of outfits to suit all conditions, but assist Central Stations and dealers in obtaining inquiries and in making satisfactory installations.

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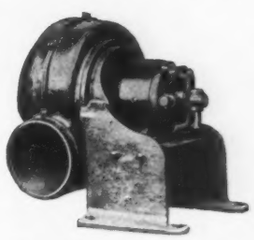
Sales Offices in all Large American Cities



For Ventilating the Operator's Booth—The Westinghouse Sirocco Blower, which forces air through pipes, is ideal for ventilating the moving picture machine operator's booth. It is also applicable for ventilating inside rooms and offices, telephone booths, underground vaults, lavatories, etc.

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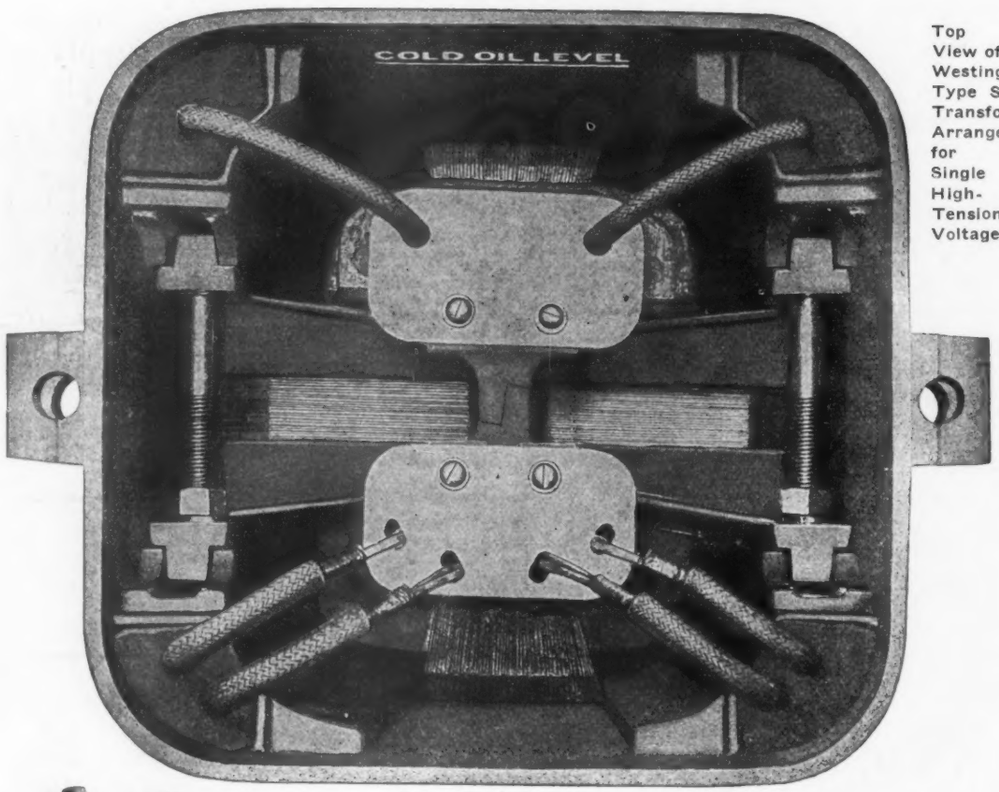
Standardization that meets operating requirements;—are available with the single High Tension Voltage in—

Westinghouse Type S & SA Distributing Transformers

For Standard 2200 Volt-Class Service



Top View of Westinghouse Type S Transformer Arranged for Single High-Tension Voltage

Note the support and insulation of the porcelain spacer in place of a high-tension terminal board; the leads supported in a positive yet simple manner; separate porcelain spacers for high and low-tension leads; top of transformers as well as condition of oil open for inspection; short stretch of leads between supports. The varnished cambric, braid-covered cables on inside of transformer case pass directly to inside of porcelain outlet bushings where joint is made to weather-proof cable.

These "Reliability" details are typical of other important features, both mechanical and electrical. Westinghouse Type S Transformers continue to lead in representing the utmost

Safety *Reliability* *Economy* *Durability*

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Sales Offices in all Large American Cities. **East Pittsburgh, Pa.**

Meter your polyphase-motor circuits, where the charges are based on maximum demand and power delivered—with

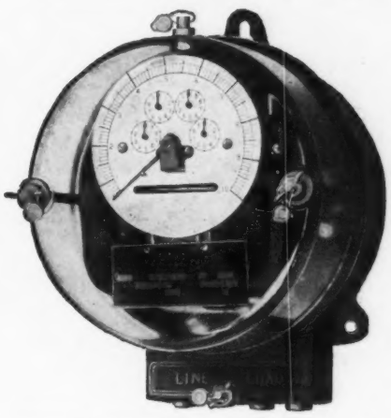
Westinghouse Polyphase Type RO Watthour Demand Meters

The Polyphase Type RO Watthour Demand Meter is not a new device. It is an addition to our line of RO Demand Meters of the single-phase type.

The advantages of these meters consist in having the integrating and demand element contained within one case, with a corresponding price economy.

No clock-timing element is involved and no electric contacts. This simplification of operation and construction contributes to reliability in service.

Type RO Polyphase Watthour Demand Meter.



Type RO Single-Phase Watthour Demand Meter.

Type RO Demand Watthour Meters are installed the same as ordinary watthour meters, and require no additional apparatus or wiring.

Catalogue Section DS-977 describes both the Polyphase and Single Phase Type RO Watthour Demand Meter.

Westinghouse Electric & Manufacturing Co.

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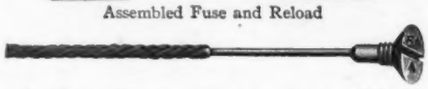
Assembled Fuse and Reload



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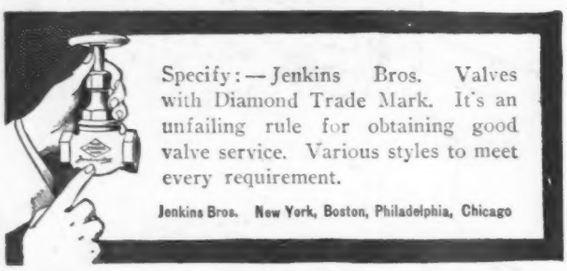

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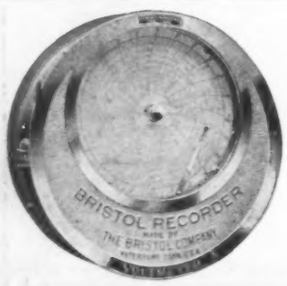

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the actual time the power was off, settling the dispute immediately. A typical instance of how these instruments induce *uniformly efficient operating conditions* by means of accurate operating records. Furnished for all commercial ranges of voltage on both D.C. and A.C. Circuits. *Write for Bulletin* L-131.
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